THE UNIVERSITY
OF ILLINOIS
LIBRARY

629.105
AEA
v.14

REMOTE STORAGE

ENGINEERING

ALTGELD HALL STACKS


Digitized by the Internet Archive
in 2023 with funding from
University of Illinois Urbana-Champaign

https://archive.org/details/aerialage1419unse

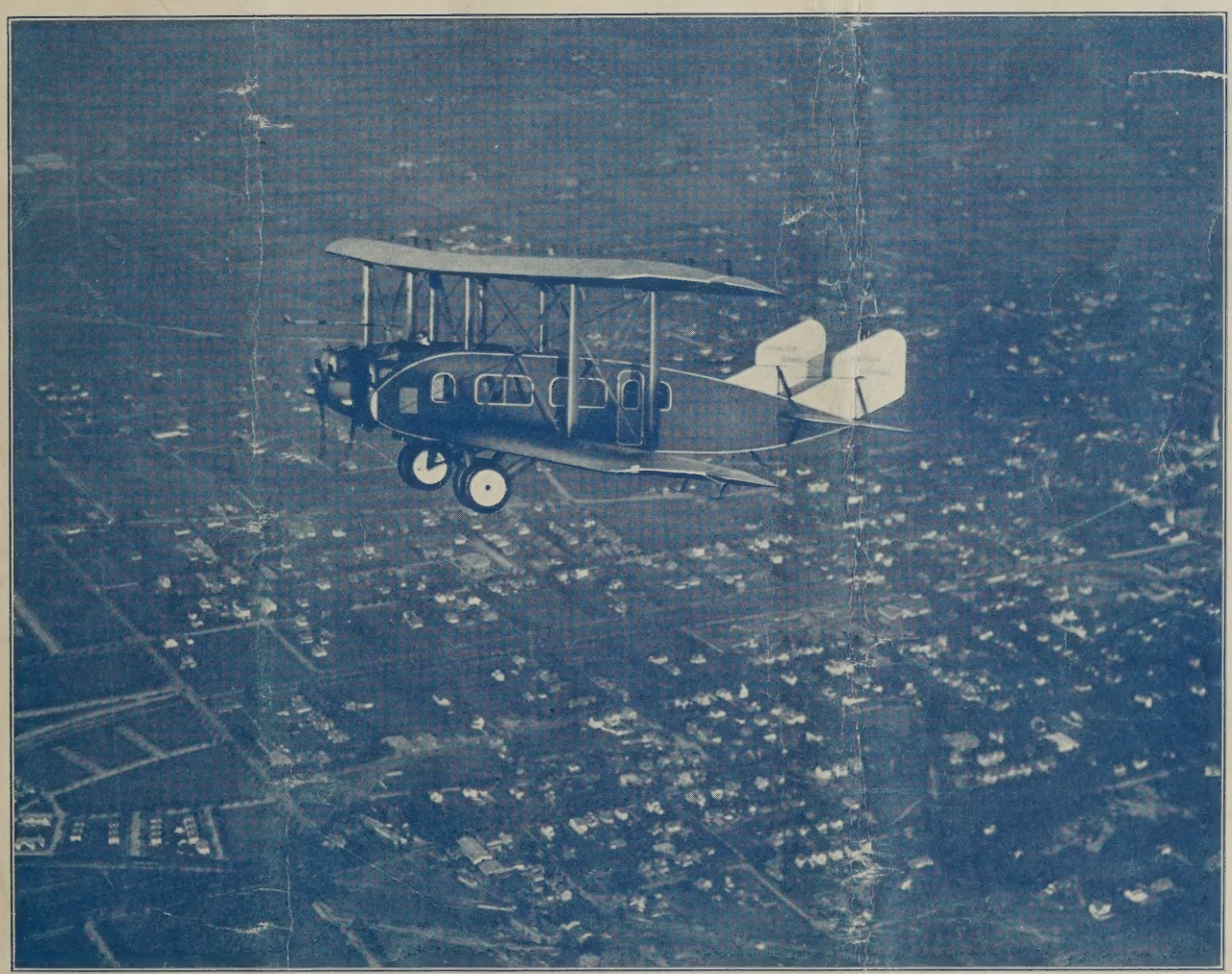
The pages which are missing were removed because they were advertisements

629.105
AEA

SEP 12 1921 STORAGE

AERIAL AGE WEEKLY

VOL. 14, No. 1 SEPTEMBER 12, 1921 10 CENTS A COPY



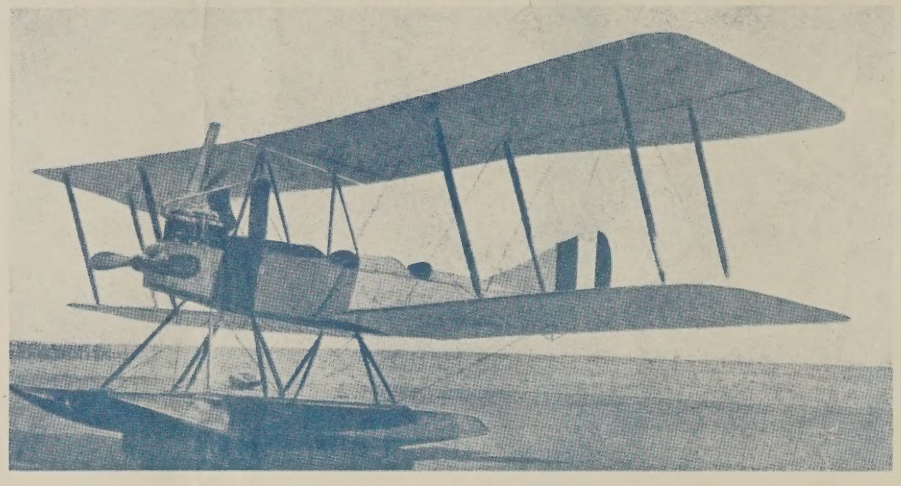
The Remington-Burnelli Airliner Cruising Over Long Island

Weight Estimation in Aeroplane Design

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



BUY IT FROM ★ ★ THE NAVY



·Boeing Sea-Plane·

The *Boeing Sea-Plane* is a tractor biplane, equipped with a *Hall-Scott 100-horsepower engine*. It is a two-float type with two places and dual control wheels. The draft when fully loaded is fourteen inches. The wing spread is about 44 feet and the supporting surface, including ailerons is 495 square feet. The weight light, including instruments and water is 1,940 pounds and the total weight is 2,450 pounds, which gives 5 pounds per square foot and 24.6 pounds per horsepower

The maximum and landing speeds are 73 and 46 miles per hour respectively, the climb is 2,500 feet in ten minutes and the endurance is 2.2 hours.

The *Boeing Sea-Plane* is manufactured by the Boeing Airplane Company, Seattle, Wash.

The planes are located at the Naval Air Station, San Diego, Calif.

They are new and unused and have not been removed from the original packing crates.

Cost (approximately) $10,300.00. Sale price $1,500.00.

Handling trucks for Boeing Planes $ 100.00.

Curtiss "OX" and "OXX" Curtiss "V-2" 200 HP Sturtevant 140 HP. U.S.A-12 Liberty Hall-Scott A-7-A Hall-Scott A-5-A. Wisconsin, Renault, Gnome, Fiat. . . . . .

Radiators, Tachometers, Altimeters, Thermometers, Aero Watches, Clocks, Compasses, Barographs, Cameras, Propellors, Spark Plugs . . . . . .

Write for Illustrated and Descriptive Catalog **Today**

CENTRAL SALES OFFICE

Bureau of Supplies and Accounts

NAVY DEPARTMENT, WASHINGTON, D. C.

Sales Room Bldg., 176 Navy Yard

Washington, D. C.

G29.105
AEA
V.14

Engineering Library G29.105 AEA

September 12, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 1

TABLE OF CONTENTS

Weight Estimation in Aeroplane Design 3
The News of the Week 4
U. S. Post Office Air Mail Department 5
The Aircraft Trade Review 6
The Winner of the London Aerial Derby 7
The Problem of Fuel for Aviation Engines 8
The Employment of Airships for the Transport of Passengers 12
Naval and Military Aeronautics 15
Foreign News 16
Elementary Aeronautics and Model Notes 17
Aeronitis 18

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

Cox-Klemin Aircraft Corporation

Consulting, Designing & Constructing Engineers

College Point, L. I.

Telephone, Flushing 1800

FOR IMMEDIATE DELIVERY AT LOWEST PRICES

MOTORS—All New
Hispano-Suizas 150, 180 and 300 H. P.
Isotta-Fraschinis 170 and 250 H. P.
Mercedes 160 H. P.

PLANES
3 Place Standards, rebuilt from new ships and motors, with Hispano-Suiza 150 H. P., or Isotta-Fraschini 170 H.P. or Mercedes 150 H. P.
Aeromarine—40, 3 place flying boat with Isotta-Fraschini 170 H. P. motors.

AIRCRAFT MATERIAL
Radiators, propellers, Aircraft Accessories and materials.

REPAIR AND REMODELLING
A complete and highly skilled shop and engineering organization offers unequalled service in repair and remodelling of every type of craft at the most reasonable terms. We specialize in this work and can give prompt estimates

SPECIAL AIRCRAFT
Designed and built to meet every requirement and specification.

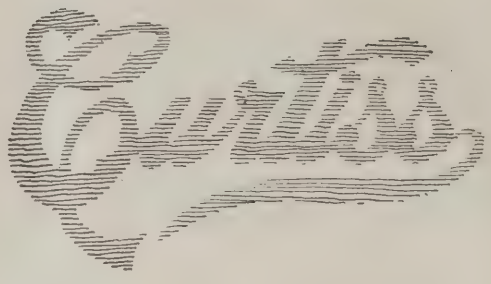
CONSULTATION SERVICE
To Transportation Companies in the laying out of airways, analysis of costs, financial and technical reports, and purchase of planes, motors and materials.

INVENTIONS
Design, Development and Construction.

WRITE FOR PRICES AND CATALOG

All inquiries promptly dealt with. Write in and state your requirements.

588770



DISTRIBUTORS OF THE PRODUCTS
OF THE
CURTISS AEROPLANE & MOTOR CORPORATION:

THE STATE OF ILLINOIS, Branch Sales Office of the parent corporation	**Curtiss Aeroplane & Motor Corporation,** 30 North Michigan Ave., Chicago, Ills.
THE STATE OF MICHIGAN, EXCEPTING THE UPPER PENINSULA	**Thompson Airplane Company,** 2927 Woodward Ave., Detroit, Mich.
MOST OF THE STATE OF OHIO	**Floyd J. Logan** 712 Superior Ave., N. W., Cleveland, Ohio.
THE STATE OF IOWA	**Curtiss Iowa Aircraft Corporation,** Fort Dodge, Iowa.
MOST OF THE STATE OF MISSOURI	**St. Louis-Curtiss Airplane Company,** 6426 Floyd Ave., St. Louis, Missouri.
THE STATE OF INDIANA	**Curtiss Indiana Company,** Kokomo, Indiana.
MOST OF THE STATES OF ALABAMA AND GEORGIA	**Curtiss Bond Airplane Company,** Montgomery. Alabama.
THE STATES OF OREGON, WASHINGTON & IDAHO	**Oregon, Washington & Idaho Company,** 1209 Yeon Bldg., Portland, Ore.
THE STATES OF VIRGINIA & NORTH CAROLINA	**Lynchburg Air Service Co.** 218 Wall Bldg., Lynchburg, Virginia.
THE STATES OF NEVADA AND NORTHERN CALIFORNIA	**Earl P. Cooper Airplane & Motor Corporation,** Sutter & Gough Sts., San Francisco, Calif.
THE STATE OF NEBRASKA	**Grand Island Aero Company,** Grand Island, Nebraska.
THE STATE OF WISCONSIN AND UPPER PENINSULA OF MICHIGAN	**Curtiss Wisconsin Airplane Company,** 330 Clinton St., Milwaukee, Wisc.
THE STATES OF NEW MEXICO, UTAH, WYOMING, AND COLORADO	**Curtiss Humphreys Airplane Company,** 1st Nat'l Bank Bldg., Denver, Colo.
THE STATES OF PENNSYLVANIA, MARYLAND, DELAWARE & SOUTHERN NEW JERSEY	**Curtiss Eastern Airplane Company,** 130 S. 15th St., Philadelphia, Penna.
THE STATES OF MINNESOTA, THE DAKOTAS, AND MONTANA	**Curtiss Northwest Airplane Company,** 707 Metropolitan Bank Bldg., Minneapolis, Minn.
THE STATE OF KANSAS AND PART OF MISSOURI	**Williams & Hill Airplane Company,** Arkansas City, Kansas.
THE NEW ENGLAND STATES	**Curtiss New England Airplane Company,** Garden City, Long Island, N. Y.
THE STATES OF TEXAS, OKLAHOMA, AND UNASSIGNED TERRITORIES	**Curtiss Aircraft Corporation,** Garden City, Long Island, N. Y. Love Field, Dallas, Texas.
ALL COUNTRIES OF SOUTH AMERICA	**C. W. Webster,** Curtiss Aeroplane & Motor Corporation, Garden City, Long Island, N. Y.

DEALERS

THE STATES OF MASSACHUSETTS AND RHODE ISLAND	**Lynnway Aerial Transportation Company,** 7 Central Square, Lynn, Mass.
PARTS OF THE CAROLINAS	**H. L. Morrow Company,** 540 S. Tryon St., Charlotte, N. C.

Engineering Library
REMOTE STORAGE
Engineering Library

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

Engineering Library
629.105 AEA

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., September 12, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, SEPTEMBER 12, 1921 NO. 1

WEIGHT ESTIMATION IN AEROPLANE DESIGN

AEROPLANE design within the past few years has become less an art and more a science. Sound, painstaking engineering is taking the place of inspiration and intuition. This change has been made possible only by the gradual accumulation of accurate data on aeroplanes of various sizes and types.

Perhaps the most important single class of data which designers must have is that relating to aeroplane weights. For centuries naval architects have been collecting data on the weights of ships of every kind and the furnishings and equipment put into them. The success or failure of a ship design is largely dependent upon the accuracy with which the designer estimates his weights. A ship when launched and loaded must float on the designed water line. Fully as necessary for ships of the air as for ships of the sea is a knowledge of their weight, ready to fly.

Many factors are dependent upon the weight assumed at the beginning of a design. Among the most important of these is the strength. It is useless to carry through a careful stress analysis of the different parts of the structure, designing them for a certain load factor based on an assumed weight, and then discover too late, after the aeroplane has been built, that the weight estimate was 10 to 15 per cent in error. If the assumed weight was too low the structure is unsafe; if it was too high, the design is unnecessarily heavy, and could not compete with an aeroplane which did not have to carry around a few hundred pounds of useless, dead weight that should have been disposable load. The next factor to be seriously affected by an error in the weight estimate is the wing loading.

With a given wing section the wing area is determined early in the design either by considerations of maximum landing speed or of desired performance. Should the actual gross weight be considerably in excess of that estimated, the wing area provided would be inadequate. It is extremely awkward, usually, to increase the wing area of an aeroplane already built. Even should the higher landing speed, due to overweight, not be excessive, either the performance and maneuverability of the aeroplane are impaired or the disposable load largely reduced. In the old days when a designer was thankful for whatever load his aeroplane would carry and did not worry particularly if the performance was low, this matter of overweight did not trouble him greatly. Today, however, the standards are set so high that a designer with all the skill and knowledge at his command can hardly meet them. He cannot afford to run over his estimated weights by more than a small margin. The fundamental importance of accuracy in weight estimation is evident.

Unfortunately the data which designers must use in the preparation of weight estimates are neither very abundant nor too correct. A common cause for error, particularly in the case of the fuselage weight, is not due to a mistake in recording the correct scale reading but in failure to note in detail exactly what was weighed, whether or not the fuselage contained tanks, seats, controls and other furnishings. Some of the lack of accuracy in weight data can be attributed to the fact that information of this kind may become obsolete because of alterations in the design of the parts weighed.

Data relating to older designs are either entirely inapplicable to new types of construction and materials or can be used only with the most careful judgment. For example, weights of the structure of aeroplanes built of wood are of no value in preparing a quantitative weight estimate for an all metal aeroplane. Also, the weight of the cellule of an externally braced wing furnishes no accurate guide to determine the weight of an internally braced wing. A large increase in size in aeroplanes of the same type of construction, employing the same materials may greatly alter the ratio between the weights of the various parts of the aeroplane structure and the gross weight of the aeroplane. The proportion between the disposable load of an aeroplane and its entire weight influences the proportion between the weight of the structure and the gross weight. With a given power plant and factor of safety, the larger the disposable load the smaller becomes the percentage that the structure forms of the total weight. Again, if the disposable load remains fixed and the weight of the power plant varies, the ratio between the structural weight and the gross weight will vary, assuming the safety factor to be constant. As the pounds per horsepower become higher the structural weight of an aeroplane will become a larger proportion of its total weight. It is obvious what the effect of increasing the safety factor will be on this ratio.

These are some of the reasons why it is so difficult to get satisfactory results from existing weight data, especially if the information is not recent. Aerial Age within a few weeks will contain several articles which will do much to aid designers in the preparation of trustworthy weight estimates.

B. C. B.



THE NEWS OF THE WEEK



Memorial Service for ZR-2 Victims

The people of Hull, where the tragedy of the dirigible ZR-2, which was wrecked last week, participated September 1 in a big memorial service for the victims.

Preceding the service at the Holy Trinity Church, there was a procession from the Guild Hall, in which marched the Lord Mayor, the Sheriff and other city officials. United States Consul Grout was the chief mourner for the American dead. In the procession were representatives of local civic bodies, units of the British Army and Navy, Commander Byrd, with officers and men of the United States Navy at Hull, two officers and six men of the American Air Service detachment at the Howden aerodrome, Air Vice Marshal Vyvyan of the Royal Force, and representatives of the Y. M. C. A., headed by George D. Whitehead, Senior Secretary of the American Y. M. C. A. in England.

Despite rain thousands of persons lined the route of the procession. The black worn by the clergy and the main body of marchers was relieved by the vivid colors of the robes of municipal officials. They wore the full insignia of office over the quaint costumes prescribed by ancient customs, the Aldermen in scarlet and the Councilors in blue. The mace bearer and Town Clerk preceded the Lord Mayor, who, in resplendent regalia and gold chain, led the procession. Consul Grout accompanied the Lord Mayor.

A contingent that added impressiveness to the column was composed of the Trinity House Brothers, a rich and famous charitable society dating back to the thirteenth century.

From public buildings the Union Jack floated at half mast.

Although Holy Trinity Church, which was built in 1306, is the largest parish church in England, it was unable to accommodate more than a fraction of those seeking admittance. Seats were reserved for the large number of relatives of the victims and for Rear Admiral Haworth, as well as for his three daughters, one of whom was engaged to one of the British officers of the airship who lost his life.

The service was conducted by the vicar of the church, Canon George Buchanan. It was concluded with the national anthem and "The Last Post," by a bugler of the naval band. While the band played Chopin's funeral march a number of women were overcome, several of them fainting.

The American and British flags were entwined about the altar. Canon Buchanan in his sermon remarked that "the very nature of the tragedy will draw the two nations more closely together."

With the finding of Commander Maxfield's body, only four American victims remain unaccounted for.

Sir Richard Gregory Criticizes Air Ministry

In an article on the R-38 disaster in *Nature*, a weekly scientific magazine, edited by Sir Richard Gregory, the British Air Ministry is sharply attacked for its alleged lack of experimental and research work on airships.

"Airship design as known to us," *Nature* says, "has been a matter of guessing and not of calculation founded on scientific knowledge. The policy first dictated by the Admiralty and more recently by the Air Ministry has never given any effective opportunity for the accumulation of scientific knowledge, on which alone a rapid advance in construction could safely proceed.

"Having neither knowledge nor experience of our own, Great Britain has been reduced to copying, as faithfully as possible, such German designs as we have been able to capture. That a lack of knowledge and not any concession to essential utility accounts for the present calamity may be inferred from the fact that the weight of the girders of the gas fabric was much less than half the gross weight of the ship, and that a modification of the proportions of the total weight could have been made for the purpose of strengthening the girders had the necessity been foreseen.

"The Air Ministry has assumed a great responsibility by its failure in the last two years to provide adequate facilities for fundamental research on airships."

Sidney Veit Knight of the Legion of Honor

Mr. Sidney B. Veit, an old American resident in Paris, of 98 boulevard des Batignolles, has been awarded the rank of knight of the legion of honor by the French government for services rendered in commerce, aeronautics and war relief work.

Mr. Veit, who has spent a great part of his life in Paris, is engaged in the export and import business principally between the United States and France. He is a strong promoter of artistic efforts of beginners and is one of the founders of "Les Amis des Artistes" which aids needy artists by the purchase of their works.

He is greatly interested in aeronautics and is the honorary secretary of the Foreign Service committee of the Aero club of America. During the war he was one of the organizers of the American aviators' club in the Champs-Elysées.

One of the recent accomplishments of Mr. Sidney B. Veit, in conjunction with a group of friends, including particularly Dr. A. L. Hipwell of 91 avenue des Champs-Elysées, is the raising of funds for the erection of a monument to the soldier dead of Barbizon, a little town on the edge of the forest of Fontainebleau.

Landing Field at Springfield

An aeroplane landing field has been established at Springfield, Vermont, largely through the initiative of Governor Hartness, who is keenly interested in aeronautics.

Amphibious Planes for London-Paris Trip Service

Experiments will shortly be made with a view of organizing a Paris-London air service with amphibious machines which will be able to carry passengers from the centre of one city to the centre of the other.

Convenient points will be chosen in the Thames and the Seine where the machines will alight on the river. The machines will be so built that they can also, if necessary, land at aerodromes and other convenient points in case of engine trouble.

The advantage of this means of transport will be to shorten considerably the time now necessary in order to travel by air. The aerodromes are far from the centre of the cities and much time is lost by automobile transport to starting points and from landing places. It will also be possible to reduce the price of the journey owing to this suppression of its automobile section.

Spirited Debate on Aerial Law

Spirited debate developed when the report of the special committee on the law of aviation came before the American Bar Association convention in Cincinnati. Charles A. Boston of New York, Chairman of the committee said: "The United States is pitifully behind some of the smaller nations of the world in the development of aeronautics, and it is imperative that something be done to bring this country forward."

"Other nations," he said later, "have adopted laws covering the air and the United States is technically under an aeronautical boycott.

"The lack of law has several drawbacks that have stood in the way of development of commercial flying. This committee has learned that the law is defective, and not the aircraft. Capital does not want to invest in its development under present conditions."

Mr. Boston declared that it was the opinion of the committee that, to put the United States on an equal basis with other countries in aviation, it would be necessary to resort to constitutional amendment.

He moved the adoption of the following recommendations made to the Executive Committee:

"First—That the members of the association be requested to give their attention to the fundamental problems of jurisprudence, and especially of constitutional law, involved in the proper solution of the demands of aeronautics.

"Second—That a copy of the report of the committee be placed in the hands of the President and each member of Congress and each member of the National Advisory Committee for Aeronautics and in the Library of Congress and the Smithsonian Institution, and that two copies be given to each of the Commissioners of uniform State laws, and that 1,000 copies be made available for distribution to those especially interested in the subject, to the end that its subject matter may be duly considered in the enactment of any legislation.

"Third—That the American Bar Association at the annual meeting express its hope that, in the enactment of any legislation by the Congress, the most careful preliminary consideration be given to the constitutional features of any proposed legislation, to the end that it may be determined whether the proper development and regulation of aeronautics does not require a constitutional amendment conferring complete jurisdiction over aeronautics upon the United States through its appropriate departments, instead of attempting to adopt devices of questionable constitutionality to make existing national powers apply to this new branch of human activity; and that, meanwhile, all national legislation studiously observe the existing constitutional limitations and preserve without assault the existing division of powers between the United States and the States of the Union; and that all constitutional State legislation involving matters of purely

local interest and application shall be studiously made uniform. That the committee be continued as a special committee of the association."

William V. Rooker of Indianapolis led a fight against adoption of the report, urging more immediate action toward the passage of aviation laws. Mr. Rooker declared that the recommendations attacked the patriotism and integrity of Congress.

"When the matter of aviation," he said, "was brought up before this convention I did not know that it was going to hamstring this industry. I ask the American Bar Association if it will adopt a thing on the theory that 'the world is flat'? You cannot partition the ocean or the air."

After giving reasons why aviation should come under the Admiralty laws, Mr. Rooker said: "If this committee wanted to work off stocks and bonds of a railroad, and was jealous of the ocean and the air, it would be a good way to begin."

Mr. Boston jumped to his feet, demanding that he be recognized as a point of personal privilege. Before he could reply, however, Mr. Rooker withdrew his statement.

W. J. Davis of California, who said he had been a member of the Air Service, declared passage of the recommendations would cripple aviation for two years.

He moved the adoption of a substitute recommendation, asking Congress immediately to legislate for the regulation of aircraft, and leaving Congress to determine the question of constitutionality. This motion was voted down.

Mr. Boston, in closing the debate, answered the charges made by Mr. Rooker, declaring that the committee had no intention of attacking the integrity of any member of Congress or any other person.

A second substitute offered was voted down, and by a large majority the recommendations of the committee were adopted.

3½ Mile Gliding Record

A report September 2 from Hesse-Cassel, Prussia, said that an engineer named Klemperer succeeded in traveling five kilometers (3⅛ miles) in a monoplane without an engine, covering the distance in thirteen minutes. He is said to have started from a point 920 meters high, and to have maintained that level about ten minutes.

Chinese Aeroplane Gives Excellent Performance

WASHINGTON—Several successful flights have been made with a hydro-aeroplane constructed by Chinese engineers at the Chinese Government Dock & Engineering Works at Foochow, according to a report made to the Bureau of Foreign and Domestic Commerce. All the material used in the construction of this plane, which was specially designed by a Chinese engineer, with the exception of the engine, which is of American design and manufacture, was produced in China. The works have several more of this type of aeroplane under construction for use by the Chinese navy. The success so far achieved is expected to give quite an impetus to aviation development in China.

Engineers to Meet October 10

Several hundred American engineers will foregather with representatives of the principal engineering societies of Great Britain and France at a dinner to be given at the Engineers' Club in New York on the evening of Oct. 10.

The dinner, while formally celebrating the homecoming of the mission of American engineers who went abroad to confer the John Fritz Medal upon Sir Robert Hadfield of London and Eugene Schneider of Paris, will mark the launching of a new movement to bring English and American engineers together. The profession hopes to open up a fresh channel of international amity, paralleling broadly such contacts as those established by the Carnegie Endowment for International Peace, the Sulgrave Institution and the English-Speaking Union.

The guests at the dinner will include the twelve members of the deputation which represented the John Fritz Medal Board and representatives of the British and French societies by which they were received. Invitations have been extended to many men prominent in public life, including Herbert Hoover, Secretary of Commerce; Viscount Bryce and Charles E. Hughes, Secretary of State.

Others who will attend are the governing boards of the four national engineering societies, the John Fritz Medal Board of Award, the Library Board of the Engineering Societies and of the Engineers Club; the Trustees of the United Engineering Society, and the officers of the Federated American Engineering Societies, from the presidency of which Secretary Hoover retired soon after he became a member of the Cabinet.

Hoover Plans Regulations For Commercial Aviation

Washington, D. C.—Investigation into the probable scope of government regulation of commercial aviation under proposed legislation has been begun by the Commerce Department, Secretary Hoover said Sept. 5.

Government supervision of air traffic along the lines of rail and water regulation was recommended, he said, by a committee of experts of the War, Navy and other departments to increase the safety and more efficient development of the new method of transportation.

Enactment of enabling legislation, Mr. Hoover indicated, probably would result in the creation of a bureau of aviation charged with the enforcement of the rules of air travel similarly to the activities of the Bureau of Navigation in connection with water carriers.

Chicago Aerial Derby

As a special Labor Day event the Aero Club of Illinois organized an aerial derby exclusively for J.N. machines equipped with 90 H. P. motors. Following is a list of the pilots entered: Elmer Partridge, William Westlake, James Curran, Dick Bookland, Nelson Kelly, Price Hollingsworth, James Pugh, Pop Keller, David L. Behnke, Bert Blair, Dan Kiser and Charles Dickinson. The results of the contest will be published in our next issue.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, July, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
														Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
															hr. min.			
Eastern New York-Chicago	$5,029.87	$1,068.92	*$7,632.08	$3,123.75	$1,803.32	$695.18	$3,536.00	$1,553.55	$4,873.15	$5,621.65	$2,792.43	$876.19	$38,606.09	13,772	507 54	43,220	$74.81	$0.89
Central Chicago-Rock Springs	6,551.03	1,542.11	3,158.15	4,302.62	1,017.96	288.05	3,089.89	2,249.97	5,969.75	4,821.18	4,044.21	1,268.97	38,303.89	22,361	667 32	62,639	57.98	.61
Western Rock Springs San Francisco	3,733.24	766.68	**9,522.49	2,332.70	1,144.60	225.82	2,678.63	1,553.56	3,793.24	3,469.35	2,792.43	876.19	32,889.13	12,492	469 00	42,825	70.13	.77
Totals and Averages	$15,314.14	$3,377.71	$20,312.72	$9,759.07	$3,966.08	$1,209.05	$9,304.52	$5,357.08	$14,636.14	$13,912.18	$9,629.07	$3,021.35	$109,799.11	48,625	1,644 26	148,684	$66.76	$0.73

* Includes new engine in plane No. 191.
** Includes new wings on planes Nos. 74, 104 and 149.

Cost of dismantling College Park Field, formerly on New York-Washington Division	$1,442.58
Loss on unrepairable crashes	20,000.00
Permanent improvements	2,769.56
Total operating costs	109,799.11
Grand Total	$134,011.25

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio.
Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories and Warehouse.
Flying consists of: Gas; Grease and Oil, and Pilots.

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern	$0.23	$0.25	$0.41
Central	.15	.23	.23
Western	.18	.20	.39
Entire Service	$0.18	$0.22	$0.33

E. H. SHAUGHNESSY, Second Assistant Postmaster General.



An Aeromarine Record

A new world's record in aerial transportation is announced in the official report concerning the operations of the giant flying cruiser Santa Maria, which was forwarded to the Bureau of Aeronautics of the Navy Department by Aeromarine Airways of New York. The Santa Maria is the largest passenger carrying flying boat in the world in daily operation; it has accommodations for eleven passengers, and a crew of four. Since she was launched a little over a year ago she has flown 20,000 miles without a single accident to her passengers.

The big flying cruiser is now at Peoria, Ill., ready to start on the final leg of an aerial circumnavigation of the Eastern section of the United States, which when completed will aggregate more than ten thousand miles. The Santa Maria has already flown from Cuba by way of New York and Montreal, Buffalo, Cleveland, Detroit and Chicago to Peoria, carrying eleven passengers and their baggage. The flight included a circumnavigation of the Great Lakes.

She is now about to fly down the Mississippi River to New Orleans and thence to Vera Cruz, Mexico, here she will take part in the aeronautical exposition, as the largest craft of her kind in the world.

Among her passengers on the forthcoming flight, which commences Thursday, September 1st, will be Congressman F. C. Hicks, chairman of the House Committee on Aeronautics, and a representative of the United States Army Air Service.

The Santa Maria has two Pullman cabins with reclining chairs for her passengers. She is equipped with two 400 horsepower Liberty motors, and has a speed of approximately one hundred miles an hour, but generally cruises at eighty miles an hour.

Her ten thousand mile flight around the Eastern section of the country was undertaken for the purpose of demonstrating the possibilities of commercial air transport in co-operation with the U. S. Navy.

The flight of the Santa Maria along the Atlantic Coast up the Hudson and around the Great Lakes has been met at every city with tremendous receptions headed by the Chamber of Commerce and various civic organizations, and in a statement just issued by C. F. Redden, President of the Aeromarine Airways Company, it is quite probable that the operations of his company—which now include a daily passenger and mail line between Key West and Florida and points up and down the Atlantic Coast—will be extended to cover many points on the Great Lakes and up and down the Mississippi River.

Maquire Quick Service

As United States Army aeroplanes were included in the military forces concentrated in the West Virginia Coal Mine Riot Zone, The C. L. Maguire Petroleum Co., on Sept. 2nd subsequently received an order for 2 cars of Lakeside Aviation oil to be shipped direct to the military command in the riot area.

An outstanding feature of the transaction was the service given the order by the Maguire Company who dispatched the shipment by express within 24 hours after the order was placed.

Robertson Aircraft Enlarges

The Robertson Aircraft Corporation, due to the increased volume of business, has found it necessary to enlarge its quarters and have consequently moved to its new quarters at 5248 Oakland Ave., St. Louis, Mo., immediately opposite the St. Louis Municipal Flying Field in Forest Park (The U. S. Mail Field).

Palmer With Air Service Co.

Capt. W. W. Palmer, distinguished aviator, and formerly Flight Commander with Eddie Rickenbacker's Hat-in-the-Ring Squadron, has accepted the position of General Manager of The Air Service Company of Cincinnati, and will make his home in Cincinnati henceforth. Capt. Palmer was several times decorated during his service overseas, and wears the D. S. C., and the Croix de Guerre.

The Air Service Co., under Capt. Palmer's management, will open a forty-two acre field, on the outskirts of the city of Cincinnati and the company is now prepared to care for visiting flyers. Oil, gas, repairs and all other accommodations are now available.

Successful Fokker Demonstrations

The first of the Fokker F 3 monoplanes which has been christened the "Half Moon," after the tiny Dutch ship in which Hendrik Hudson came to this country and sailed up the Hudson River in the year of 1609, has now carried over 700 passengers since its appearance at Hazelhurst Field on July 21st.

Very successful demonstrations during which hundreds of people were introduced to the delights of a commercial aeroplane as a means of travel, were held at Washington, D. C., Hartford, Conn., and Camp Vail, New Jersey. Bert Acosta, who piloted the machine, appears thoroughly in love with his mount.

From point of view of economical transportation, the Fokker machine is believed to have made a record gasoline consumption during all this flying working out at an average of 8 gallons per hour.

The Netherlands Aircraft Manufacturing Co., believe that by interesting the public in aviation in this way and showing what modern commercial planes can do, they will pave the way for the establishment of air transportation as a recognized means of traffic in this country, as it already is in Europe.

Schroeder with National Aircraft Underwriters

Major R. W. Schroeder, who established the world's altitude record in a flight at Dayton, Ohio, by ascending 33,114 feet, has joined the staff of the laboratories of the National Aircraft Underwriters' Association. Major Schroeder, who was for several years chief test pilot of the United States Army Air Service, will now take a leading part in the classification of aeroplanes and aviators for insurance purposes.

New York-San Francisco Tour

Mr. James Otis, president of Otis, McAllister and Company, exporters, of San Francisco, completed on August 30th the Trans-continental Tour from New York to San Francisco by aeroplane which was begun on August 23d.

Mr. Otis purchased on August 18th, from the Aero Import Corporation a three place Ansaldo Fiat aeroplane of the model known as A300-3. He left Mineola on the twenty-third with the pilot of the Aero Import Corporation, Mr. Lloyd Bertaud, flying the plane, and the corporation's chief mechanic, Gio Campiglie, as the third passenger. No attempt at speed was made and flying was done only for five or six hours daily.

The only incident in the long trip was a short delay due to the malfunctioning of one magneto, and the trip has demonstrated again the sturdy reliability of Ansaldo aeroplanes and their Fiat motors.

The plane bought by Mr. Otis was the one used on the night of May eighth, when this ship covered the distance between New York and Chicago in seven hours five minutes flying time.

Mr. Otis is one of the first of the prominent business men in California to seriously consider flying as a means of fast transportation. The plane in which he made the run across the continent is the second Ansaldo aeroplane which he has owned.

Dayton S. A. E.

The Dayton Section of the S. A. E. expects to hold its first fall meeting about Oct. 1. The subject will be radiation and will probably be treated by one of the officers of McCook Field. About Dec. 1 a paper on lubrication will be given, and in February one on all-metal aeroplane design.

Gliding in Germany

A very interesting glider has been built and flown by Herr Hans Richter, who was one of the first experimenters with gliders in Germany. He began his gliding experiments in 1908, and is said to be the earliest of all glider fliers now existing in Germany, being in fact the first German glider after the late lamented Lilienthal. In the glider produced by Richter, the aviator rests his elbows on the longitudinal members of the frame and controls the fore and aft attitude of the machine with an ordinary tail elevator operated by a short lever which is worked by a movement of the wrist. The machine is designed to be inherently stable laterally, and consequently no lateral controls are fitted. The aviator's own legs form the undercarriage of the machine.

Altogether Richter has made more than a thousand flights with his various types of gliders, and with those of other constructors. It is noteworthy that the very keenest interest is taken in Germany, where gliding competitions with quite a large number of entrants have taken place in the hills of the Rhon.

THE WINNER OF THE LONDON AERIAL DERBY

WE are indebted to our British contemporary, the *Aeroplane*, for the following facts concerning the "Mars I," which recently won the London aerial derby:

Designed by Mr. H. P. Follond, whose machines had the air almost to themselves on the day of the race, the "Mars I," as the machine is officially called, bears very obvious signs of its parentage, in that it is very largely constructed of components which form part of previous machines of his design.

The greater part of the fuselage, the undercarriage and the tail unit are constructed from the same component parts as are the same parts of the well-known "Nighthawk," and in external appearance at least are indistinguishable from those of the ancestral machine.

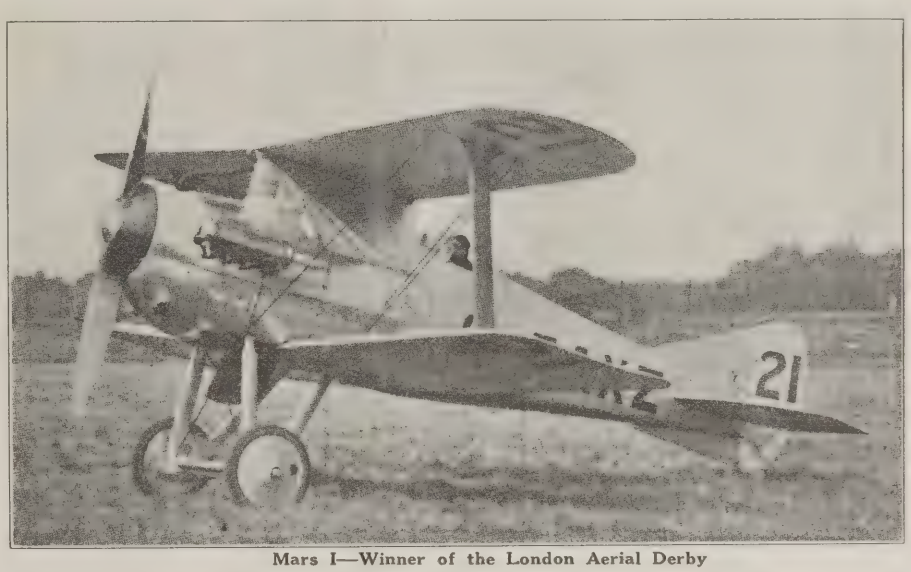
The fore end of the fuselage, instead of being provided with a steel plate serving as bearer for the radial engine of the "Nighthawk," is fitted with a multiple bulkhead supporting the engine bearers for the Napier "Lion" engine. These bearers are further supported forward by two more multiple bulkheads which are in turn supported from the after main bulkhead by a steel tube cantilever framework. The details of this mounting and the general scheme thereof are very clearly shown in certain of the photographs and sketches appended.

Immediately below the engine mounting and suspended from the two forward engine-bearer bulkheads is the oil tank, which forms at the bottom the outer surface of the complete fuselage, and is longitudinally corrugated to give ample oil cooling surface. Behind the oil tank, projecting down below the fuselage is the radiator, rectangular in elevation, and of the usual honeycomb type.

Mounted on the top of the fuselage and extending from just ahead of the back cylinders of the engine to the pilot's cockpit is a large structure, roughly triangular in front elevation, whose sides are tangent to the fuselage section and meet, or nearly meet, at the top plane. This structure is, in fact, the petrol and the water header tank, combined to act as a cabane for the upper plane.

The front end of this combined tank and cabane contains a water header tank, whose front, semi-cylindrical in form, is deeply corrugated to provide added cooling surface. The rear portion contains the petrol tank.

The advantages of this arrangement are several. In the first place it allows the simplest possible petrol system, as there is an ample gravity head to the carburetters. The pilot of a racing machine such as this has plenty of things to think about, and the complications and the risk of failure of pump or pressure-fed petrol are not desirable in such a case. Secondly, the total resistance of this solid cabane is probably no more, and may be less, than that of the equivalent four struts of usual practice. Thus the designer has been able to secure the advantages of gravity-feed petrol, together with an ample head of cooling water, without the added resistance of separate tanks outside the fuselage.



Mars I—Winner of the London Aerial Derby

The wing structure is very similar to that of Mr. Folland's previous racing machine, the "Goshawk." That is to say it is a slightly staggered biplane, equal both in chord and in span on top and bottom wings and fitted with one deep I-form strut on each side.

Top and bottom wings differ somewhat in plan form. The top wing, which has no ailerons, is rounded at front and back at the tips, the rounding being if anything more pronounced at the back. The bottom wing, which alone has ailerons, has its leading edge rounded off, much as has the top one, but has practically a square trailing tip.

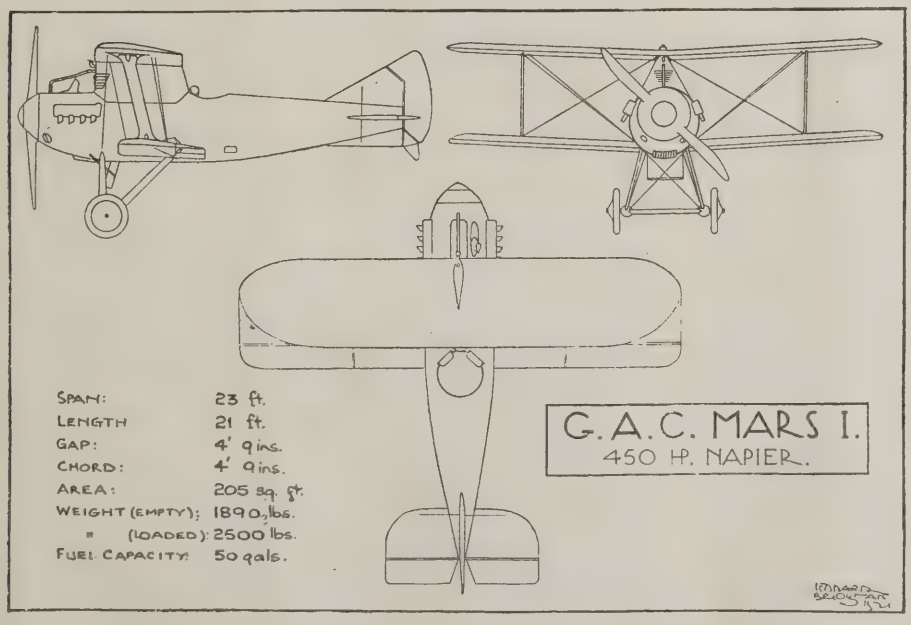
The wings proper are built in the usual way on front and rear spars. In section they are fairly thick, though of relatively small mean camber, the under surface being slightly convex downwards at the leading edge.

The wire bracing is somewhat unusual. The front spar is supported in flight by one single streamline wire on each side, running from the top of the forward undercarriage strut to the line of the interplane strut. Two such wires are carried from the top of the rear undercarriage strut to the top back spar. This duplication of the rear spar wiring only is entirely sound in a machine such as this designed solely for high speeds, for the machine will normally fly with the center of pressure far aft, and with a heavy load on the rear truss.

Only one landing wire is fitted on each side, this wire running from the top of the tank cabane to the front bottom wing spar. Thus the inherent stiffness of the wings and the interplane struts are relied on to take care of the landing loads on the rear spars. Considering the heavy loading for which the wings have been designed, and the relatively great depth available for spars, there can be little doubt that the structure is adequately stiff to meet these conditions and for speeds such as are expected of this machine, the suppression of two streamline wires on each side is an appreciable economy.

At their roots the two upper wing halves are bolted to a flange provided for the purpose on the "cabane tank." It has not yet been possible to discover how this "cabane tank" is fixed to the fuselage structure, but apart entirely from any such fixing, lift loads from the top wing roots are transmitted to the body by two pairs of cables—one from each front spar, which are attached to the two fittings to which the rear undercarriage struts are attached. The engine is extremely neatly cowled, in readily detached aluminum cowling, which, when in place, discloses only the heads of the two side cylinder blocks, and blends very smoothly into the nearly circular fuselage.

The outline of the body is completed by a large domed boss, built integrally with



the airscrew, and a small nose dome which covers the lock nuts and front flange of the engine hub.

The pilot's cockpit is immediately aft of the gasoline tank, and the pilot must be to some extent shielded from the air blast by its presence. It would at first sight appear that his view must be greatly obstructed by the presence of this erection, but it is in fact so narrow that he has an excellent view ahead on each side of the tanks. In all other directions the view is in no way modified by the peculiar construction.

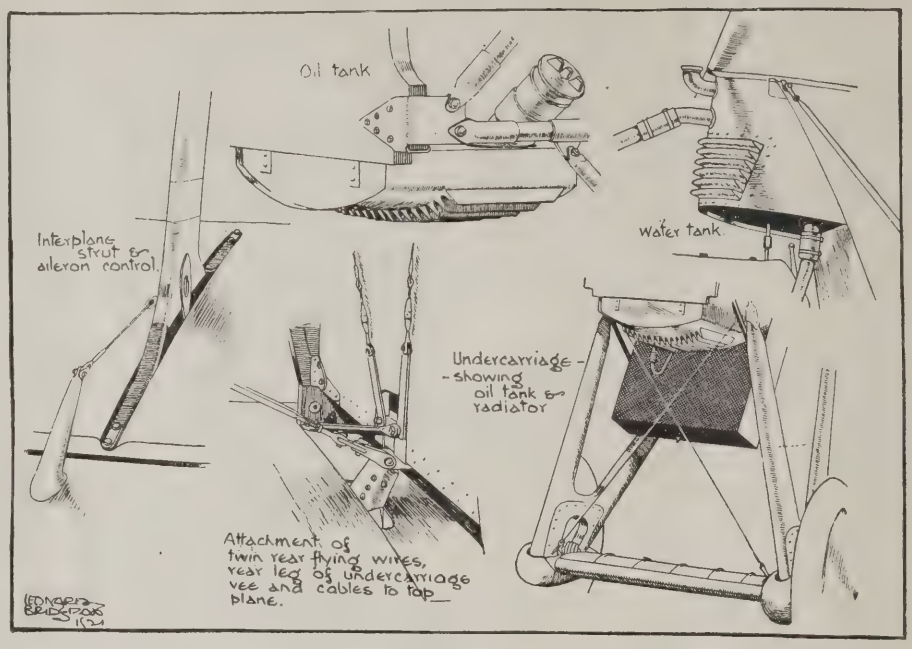
The general fuselage construction is, as has already been mentioned, similar to that of the "Nighthawk." That is to say that it is a conventional four-longeron, strutted, and swaged rod braced affair, tapering to a vertical knife edge at the stern, and faired out to an oval section by formers and laths.

The tail unit is, it is understood, identical with that of the "Nighthawk." There are fixed fins above and below the fuselage, the upper of about twice the area of the lower. These fins are followed by a "comma"-shaped rudder, slightly balanced at the top, and cut off at the bottom to accommodate the well-known steerable and streamline tailskid which was first used on S. E. 5's.

The tail plane is in no way abnormal, being of symmetrical streamline section nearly rectangular, but with the leading edge rounded in plan, and the elevators are of the usual divided type with very nearly square tips.

The undercarriage again is unaltered "Nighthawk." That is, it is generally of the standard vee-type, but each vee is a single unit, built up of plywood. These vees are united at the bottom by two steel tubes between which the undivided axle rides. Rubber shock absorbers allow the axle to move in the vertical slots at the base of the vees. These absorbers are themselves encased in an aluminum streamline casing.

A single set of streamline wire cross-bracing in the plane of the front legs of



the vees completes the undercarriage structure.

The machine is fitted with an airscrew designed specially for it by H. C. Watts. With the very little time which was available for tests of the machine before the race, it was impossible to allow for any trial and error work on airscrew, and it is very satisfactory to know that there was no need for it. The airscrew was satisfactory in every way and did all that was hoped of it.

As may be seen from the photographs, the machine is of very clean and graceful appearance, and it may be added that a close-up examination fails to show any detail which would evidence the extreme speed with which the machine was built.

It is understood that the machine will very shortly proceed to Martlesham to attack the existing speed records, and, although there may be some room for doubting whether the figure which now stands for the world's speed record will be passed, there is no likelihood that any machine now existing will be able to make a better speed on the same course.

The main particulars of the "Mars I" are given overleaf.

Specifications of the "Mars I"

Span	23 ft.
Chord	4 ft. 9 in.
Gap	4 ft. 9 in.
Stagger	1 ft. 4 in.
Total wing area	205 sq. ft.
Length over all	21 ft.
Engine	450-h.p. Napier
Fuel capacity	50 gal.
Oil capacity	5 gal.
Water capacity	7 gal.
Weight empty	1,890 lb. approx.
Weight loaded	2,500 lb.
Loading per sq. ft.	12.2 lb.
Weight per h.p.	5.5 lb.

THE PROBLEM OF FUEL FOR AVIATION ENGINES[1]

Technical Note of the National Advisory Committee for Aeronautics

THE speaker began by mentioning the physical properties which may be demanded of fuels for aviation use and the means that may be adopted by the engine manufacturers to properly meet the demands necessitated by the use of such fuel.

In the choice of a fuel the following factors must be considered: (1) its composition; (2) the quantity available; (3) the price per heat unit; and (4) the possibility of keeping stocks in aerial ports both at home and abroad. It is also important to know if the change from one fuel to another will necessitate any serious modification of the engine. With the present universal scarcity of gasoline, the day will certainly come when heavier fuel will have to be considered.

The storing of fuel in the aeroplane and supplying it to the engine are other points to be considered. Gaseous fuel, which would have to be taken on board in large gas bags or in air-tight cylinders, cannot be considered as the primary fuel on account of the space occupied by and the weight of such containers. At best it might be carried in liquid form in heat-proof containers. Solid fuels which might be pulverized or are in the form of powder (explosive material) cannot be considered, although liquefiable or soluble fuels such as naphthaline or paraffin might be used. Liquid fuels of high calorific value per unit of weight are best adapted to the purpose. Such fuels are the saturated and unsaturated hydrocarbons which not only have a high calorific value per unit weight but which may be easily supplied the engine in a very fluid state. Considering the fact that aeroplane engines must be capable of operation near the ground in the intense heat of summer and also at high altitudes in the severe cold of winter, the question of fuel supply is not of the simplest because many fuels lose their fluidity at extremely low temperatures. Special measures must therefore be taken so that at least the portion immediately required for the engine may be kept in a very fluid state either by heating with hot water, hot oil or electrical energy.

One of the most important points to be taken into consideration is that of ensuring the safety of the fuel from ignition in case of leaks in or injury to the tanks and connecting pipes such as may occur in forced landings. This brings out a property demanded of the fuel by the manufacturers of aeroplane engines, namely the possibility of quickly and easily supplying to the engine a good combustible mixture without the necessity for preparing such a mixture at a temperature or pressure other than that of the free air at the altitude at which the engine is operating. An ideal fuel would be of such a nature that it does not evaporate instantaneously in free air or at least does not form a mixture that ignites easily, but which can be mixed and gasified satisfactorily in the carburetor and will form a sufficiently inflammable mixture in the engine cylinder.

These conditions have not yet been fulfilled. Apart from insuring the safety of all the fuel pipes by double tubes and double jackets, they might be met satisfactorily in two ways. In the first of these use could be made of an explosive fuel that evaporates easily, such as gasoline or benzol, supplied in such a manner that there is no possibility of delivering fuel to the engine in excess of its instant requirements. For this

[1] Lecture given by Professor Kutzbach, of Dresden, Scientific Collaborator of the Adlershof Aeronautical Laboratory.

purpose the fuel in the tank would have to be condensed to such an extent or kept at such a low temperature that it resembles an ointment in fluidity and will not flow out of a leaky tank or it might be absorbed by some special substance to prevent its escape. In the second way, fuels could be used that do not readily gasify, i.e., fuels with high boiling points and flash points. The carburetor would be so designed or the intake air and fuel would be brought to such a condition in the manifold or in the cylinder that mixing and ignition would be satisfactory. The important question of the utilization of fuels of lower inflammability and consequently of higher boiling point and lower cost would thus depend on the engine.

The preparation of the fuel mixture in the carburetor was then discussed. The carburetor functions primarily as an ejector pump as shown in Fig. 1. The following equation (1) expresses its metering relations:

$$\frac{W_a}{W_f} = \frac{A_a}{A_f}\sqrt{\frac{D_a}{D_f}\,\frac{P_a}{P_f}}$$

W_f and W_a signify the weight of the fuel and of the air respectively and should preferably be used as a clearly defined ratio, usually in aeroplane engines one giving a slight excess of air or of fuel; A_f and A_a the cross sectional areas of flow; D_f and D_a the densities of fuel and air at the mixing point; and P_f and P_a the pressure drops at the nozzles in millimeters of water. The air velocities are only indirectly stated in this equation in the value of D_a which falls very slowly with increasing values of r.p.m.

In changing from one fuel to another, the fuel nozzle A_f must be so altered that the new fuel requirement W_f of air

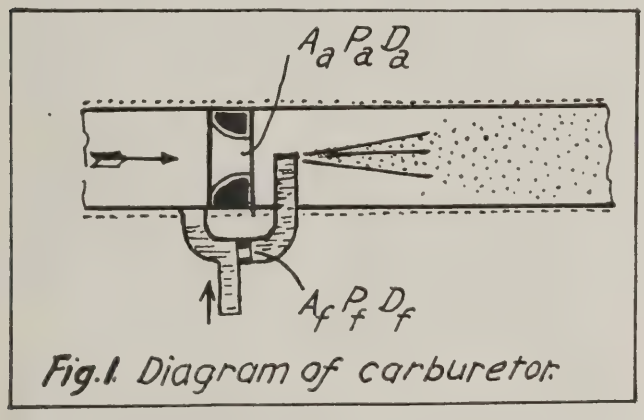


Fig.1. Diagram of carburetor.

shall be proportional to the square root of the density D_f. The ratio of the two areas would therefore be given by equation (2)

$$\frac{A_f''}{A_f'} = \frac{W_f''}{W_f'}\sqrt{\frac{D_f'}{D_f''}} \qquad (2)$$

when W_f' or W_f'' represents the weight of completely burnt fuel in chemically combining proportions with unit weight of air.

We further see by equation (1) that the mixture ratio changes with change in altitude of flight as D_a diminishes as the altitude increases, while D_f remains unchanged in the case of liquid fuel. $\frac{W_a}{W_f}$ would therefore decrease as $\sqrt{D_a}$ with increased altitude, and the engine would therefore consume more and more fuel unless preventive measures were taken. The influence of temperature is likewise expressed in D_a so that the mixture would be richer in warm weather; that is, with reduced air density.

It is especially important that any possibility of separation of the fuel and air, either in the manifold or cylinder, should be prevented. There are two fundamental ways of doing this:

1. By the finest possible atomization, whatever the load and engine speed may be. This has been proved by experience to be accomplished by high air velocities and low fuel viscosities.[2] Atomization with slow engine speed may often be found difficult.

2. By vaporization of the whole or the main part of the fuel, so that there is no longer any possibility of its separation from the air.

There is no object to be gained, however, by the vaporization of the fuel before the fuel nozzle except in the case of liquids having a very low boiling point, such as liquefied illuminating gas, methane, etc. The boiling point of the ordinary engine fuels is too high at atmospheric pressure. (See Fig. 2). Fig. 2 gives distillation curves of pure and mixed fuels from various sources. At atmospheric pressure the boiling point is far higher than atmospheric air temperatures. When light gasoline is used, provision must be made for adequate cooling at high altitudes, as it would otherwise attain boiling point on acount of the low air pressure, thus deranging the formation of the mixture and causing the engine to stop working.[3]

For liquid fuel the vaporization therefore best takes place after leaving the fuel nozzle when it is surrounded by the air for combustion which must also supply the heat for evaporation.[4] As about 12½ m.³ (441 cu. ft.) of air combine with 1 kg. (2.2 lbs.) of gasoline or petroleum, the volume of the gasoline vapor is only about 1/50, and that of petroleum only 1/200 that of the air, so the partial pressure of the fuel vapor is therefore only 1/200 of the atmospheric pressure; and the process of evaporation takes place more easily than without such low partial pressures of fuel vapor.

The quantity of liquid fuel passed through the nozzle therefore evaporates extremely rapidly in the air in consequence of its low partial pressure,—the boiling point being considerably

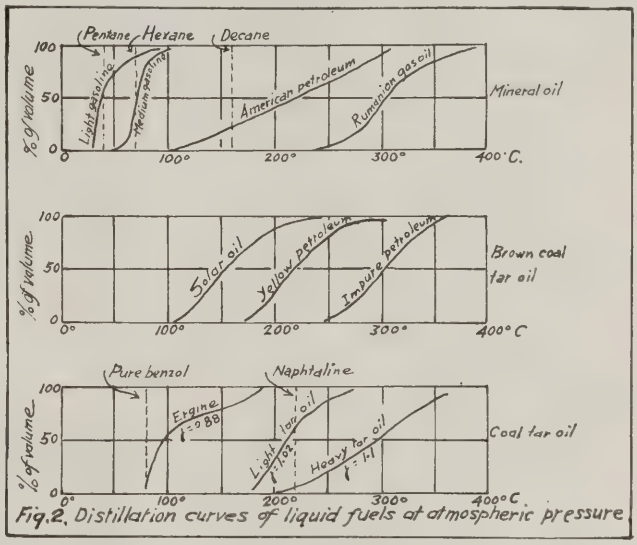


Fig.2. Distillation curves of liquid fuels at atmospheric pressure

lower than with atmospheric pressure—and continues until the saturation point of the air is reached. The air is more or less saturated after the evaporation of the fuel, depending on the boiling points of the fuel, its vapor volume and the temperature of the air. The curves in Fig. 3 show that with hexane air is saturated at —18° when there is the quantity of hexane (the principal component of gasoline[5]) necessary for good combustion, so that when the air is cooled about 30°C by evaporation, air of about +15°C suffices to bring about complete vaporization.[6] The intake air at +15°C is at first entirely free from fuel; it then evaporates rapidly, cooling and increasing the fuel content of the air at the same time. At —15°C its percentage of saturation amounts to 85 per cent when the entire fuel needed for combustion has evaporated.

Similar values are given in Fig. 4 and in Table 1 for hexane, benzol, ethylalcohol, decane (a component part of petroleum) and naphthaline, the approximate boiling points at atmospheric pressure are also given.

Table 1

Fuel	*Boiling point*	*Saturation temperature of the fuel mixture*	*Drop in temperature due to evaporization*	*Temperature of the air for complete vaporization higher than*
Hexane	70°C	—18°C	30°C	15°C
Benzol	80°	— 5°	30°	30°
Ethyl Alcohol	78°	+22°	110°	135°
Decane	160°	+42°	35°	80°
Naphthaline	220°	+92°	40°	135°

In the case of alcohol, the cooling of the air is remarkably great, chiefly because of the small amount of air in the combustible mixture, and the high latent heat of vaporization which must be supplied by that small quantity of air. Only fuel mixtures with a temperature sufficiently higher than the saturation temperature can be entirely vaporized in the short time available and thus be insured against any separation of fuel and air. Below the saturation temperature, part of the fuel is always in the form of fog or small droplets, and the

[2] See Note I.

[3] See Note II.
[4] See Note III.
[5] See Note V.
[6] See Note IV.

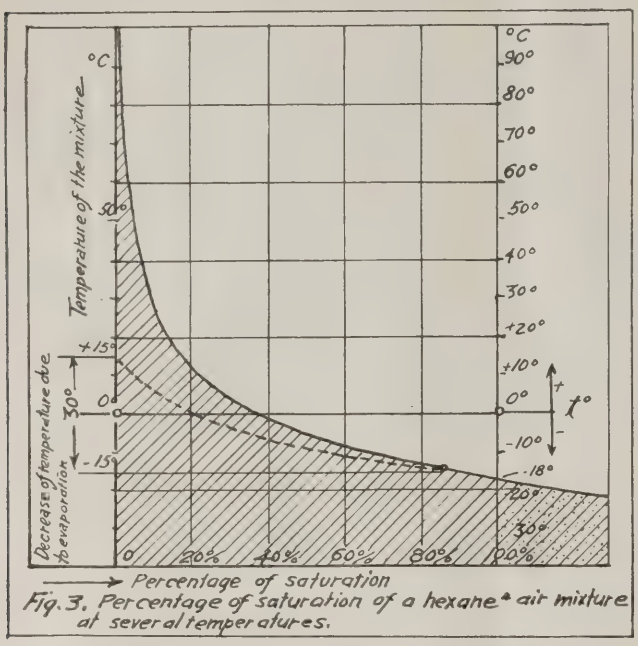


Fig. 3. Percentage of saturation of a hexane-air mixture at several temperatures.

larger the drops the greater is the possibility of the separation of the fuel.

If, however, all the walls of the pipes and of the combustion chamber be maintained at temperatures above that of saturation by the aid of the natural heat of the machine, of the heat of cooling water or of the exhaust, the risk of the separation of the mixture is sensibly diminished.[7]

There are two methods of using fuels with high boiling points, either or both of which may be applied separately or simultaneously: first, by atomizing the liquid as finely as possible at all loads; and second, by increasing the temperature of the fuel mixture and walls above the saturation temperature of the fuel-air mixture.

This increase in the temperature of the mixture and walls is difficult when starting the engine cold as it requires time to obtain heat from some source and transfer it to the mixture. The most convenient method is to start with fuel of a low boiling point and run until the desired temperatures are attained. There is one great disadvantage to be considered in the increase in temperature of the mixture, namely, the great

[7] See Note VIII.

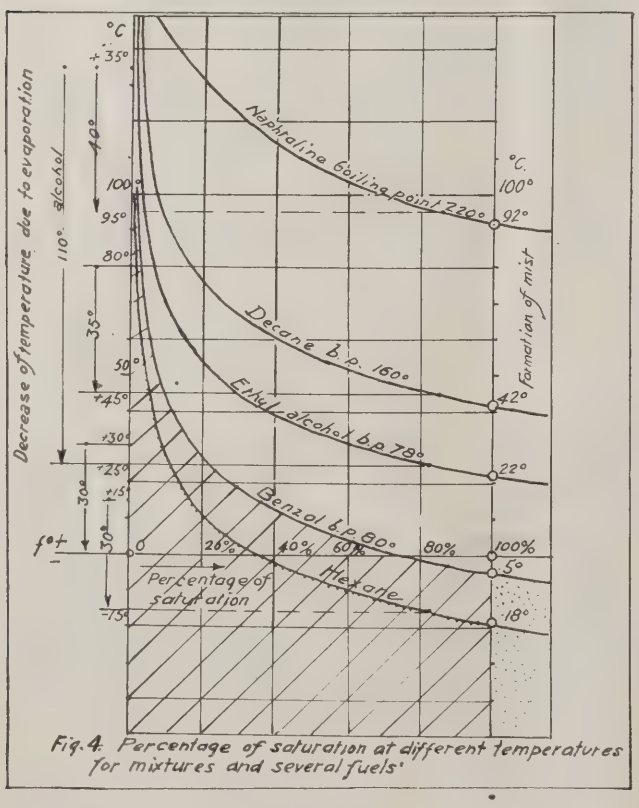


Fig. 4. Percentage of saturation at different temperatures for mixtures and several fuels.

difference in the heat supplied by the engine at different loads. In the case of the aeroplane engine, which is almost always fully loaded, this disadvantage is fortunately of no great importance.[8]

The first consequence of the increased temperature of the mixture and walls is a reduction in volumetric efficiency, E_v and likewise of the mean effective pressure of the engine, due to the decreased density of the air. The following equation gives the mean pressure:

$$p_m = \frac{427 \cdot E_t \cdot H \cdot E_v}{10000}\ ^{9} \qquad (3)$$

in which E_t indicates the thermal efficiency, and H the heating value of a unit volume of the mixture. If the air be adequately heated so that the mixture enters the cylinder at its saturation temperature, an alcohol mixture would have to be 27° warmer than one of gasoline since the saturation temperature of the former is +22°C while that of the latter is —5°C. This increase in mixture temperature would result in a 10 per cent loss of air weight at full throttle. A naphthaline-air mixture at 92° would give a greater loss. In both cases there is a loss of intake oxygen, of E_v and consequently of power. The higher the saturation temperature of the mixture as for gas-oil and heavy tar oils, the higher the point to which the preliminary heating must be carried.

It would obviously be a good plan to transfer the process of mixing to the combustion chamber itself, in order to heat the walls of the combustion chamber and also the fresh air supply in the shortest possible time. This would, however, necessitate the rejection of the simple yet marvelously effective air ejector as an atomizing and mixing device, and its replacement by a compressed air atomizer or even by the simple spraying of the required amount of fuel by means of a special pump. The less effective the atomization the longer will be the time required for vaporization, and as vaporization must be finished before ignition begins, the unfavorable atomization must be compensated for by greatly increasing the temperature of the air.

This is particularly evident in the case of engines ignited by incandescence, the air into which the fuel is injected being heated to an unusually high temperature through the red-hot, or at least extremely hot, uncooled walls. It is certainly possible to utilize all kinds of fuel with a high boiling point in these engines, but there is a great disadvantage in the unfavorable cylinder efficiency and in the after-burning of the fuel, which is too slowly vaporized and poorly mixed. For these reasons, the solution offered cannot be considered satisfactory.

The lecturer went on to say that he had personally tested the possibility of utilizing fuel with a high boiling-point by means of injection into the combustion chamber with compressed air atomizers, and that such injection could be made at any moment desired. The results showed the operation of the engine to be least reliable when injection was completed just before the ignition, although the air in the engine was then at the highest temperature. The operation was satisfactory only when injection took place while air was being taken in, in which case the prolonged period of carburetion and the stronger air currents certainly caused favorable effects. (In the case of two-stroke engines, injection can take place only during the process of scavenging or compression). The compressed air can be used for atomization or the air can be supplied at a higher velocity, by Bellem and Bregeras' process,[10] by using a very much reduced pressure in the combustion chamber during a portion of the intake stroke. By these methods there are still various possibilities of rendering fuels with a high boiling point utilizable without the great disadvantage of a marked rise in temperature outside the combustion chamber itself.

The increase in the temperature of the mixture during the intake stroke entails another disadvantage besides the reduction of volumetric efficiency, namely, that of very considerably increasing the average temperature during the whole cycle, particularly the temperature during compression. This is a very great disadvantage as it increases the risk of premature ignition in the mixture.

With regard to premature ignition itself, too little is known about it at present to enable us to give a clear and unbiased judgment as to its cause. The results that have been obtained present many facts tending to general enlightenment, and the engine itself shows most readily how it is affected by fuels and temperature.

The influence of the initial temperature of the mixture on the maximum temperatures at the conclusion of compression is shown in Fig. 5. If the compression ratio is 1 : 5, the com-

[8] See Note IX.
[9] See Note X.
[10] See Buchner's Notes on the Benzol question; Fig. 39 in the "Automobile Rundschau" 1913, and Heller's Petroleum Driving Force in Automobiles, Z. d V. d. Ing. 1919, p. 778.

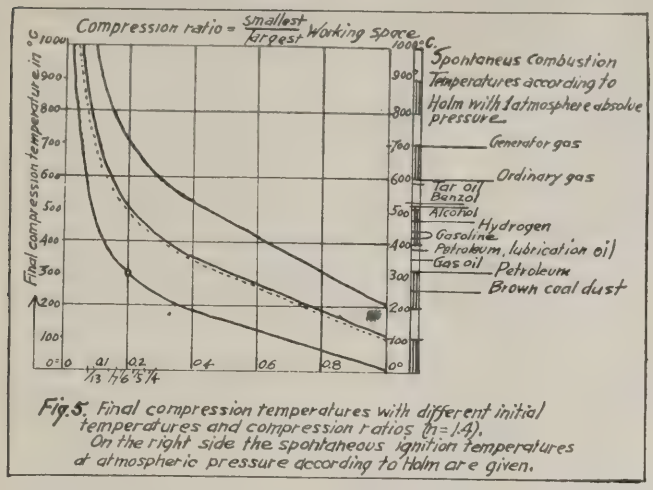


Fig. 5. Final compression temperatures with different initial temperatures and compression ratios (n=1.4). On the right side the spontaneous ignition temperatures at atmospheric pressure according to Holm are given.

pression temperature amounts to about 300°C, 500°C or even 700°C with initial temperatures of 0°C, 100°C, or 200°C. Supposing the limit of admissible compression temperatures to be about 400°C, the compression ratio must be reduced in proportion to the increase in the initial temperature. Experience has shown, however, that totally different degrees of compression are necessary in one and the same engine for different fuel mixtures; that the shape of the combustion chamber, the temperatures of the badly cooled parts, such as the piston, the exhaust valves and the spark plug, and the freedom of the top of the piston from carbon deposit have marked effects. In conclusion, we may say that the risk of premature ignition decreases as the weight of charge is reduced, although the compression ratio which determines the temperature at ignition and the composition of the mixture are not thereby altered.

Tests so planned that liquid fuel was brought into contact with air in an electric furnace[11] in which the temperature could easily be regulated were carried out at the Augsburg Nuremburg Machine Fabrik by Dr. Holm at request of the lecturer. In Fig. 5 the spontaneous ignition temperatures found by means of this somewhat crude method are given. They enable us to draw comparisons and form conclusions with regard to the action of the fuels in engines. They confirm experience which shows that engines with benzol and alcohol are generally far less inclined to premature ignition than with gasoline.

They show also that petroleum and gas-oil, for which the temperature must be raised when they are utilized in the carburetor, possess particularly low spontaneous combustion temperatures, so that there are two reasons for using a low compression ratio with these fuels.

As the thermal efficiency decreases with reduction of the compression ratio, petroleum and gas-oil appear to be most unsuitable for use with a carburetor, and tar oil very well suited. Another difficulty arises through the fact that not only the principal fuel, but also the lubricating oil used may turn the scale in causing spontaneous ignition. Hopkinson[12] made a remarkable test with an engine using ordinary gas, in which he tried to bring about premature ignition with the aid of a red-hot plug, the temperature of which he measured with thermo-elements. It was not until the temperature of the plug was 600° to 700° that premature ignition took place. If a drop of lubricating oil fell on the plug or on the exhaust valve, a temperature of 400° sufficed for spontaneous ignition. The difficult question as to what part is played by lubricating oil in spontaneous ignition, reminding one of spontaneous ignition in air compressors, here plainly crops up again.

An essential provision for the safe operation of engines with prepared fuel mixtures ignited in the engine by means of a special ignition pin is that the compression temperature should remain far lower than that of spontaneous ignition under all conditions. By selecting suitable fuel and suitable lubricating oil, it is certain that several important economical advantages might be attained. The first step necessary would be the systematic investigation of the properties mentioned, namely, the boiling points, saturation and spontaneous ignition temperatures of fuels considered usable, and the effect of these characteristics on the performance of the fuel in the engine.

If, as in the case of gas oil and petroleum, the spontaneous ignition temperature is so low that the engine can probably not be operated economically on account of the low compression ratio, all that remains is to undertake the mixture of the fuel and air immediately before ignition, allowing the mixture to burn like the flame of a gas burner in the air, as was done by Oechelhauser in the case of ordinary gas engines. Diesel applied the process to petroleum and gas-oil. In this way all risk of advanced ignition is avoided, and it becomes possible to increase the degree of compression as desired, and thereby the thermal efficiency. These combustion engines, as the lecturer termed them, in contradiction to ignition engines fired by means of an electric spark, were so designed that the finely atomized incoming fuel meets with fresh air of a temperature far higher than its spontaneous combustion temperature and is, therefore, very rapidly vaporized and burned. The test data given by Holm in Fig. 5 explains the fact that to insure spontaneous ignition of tar oil, the fresh air must be hotter than is needed for gas oil. The combustion engine, however, has the peculiarity that it is impossible for the entire weight of fresh air to be used in the combustion in the short time available. It must, therefore, work with an excess of air, and consequently with lower mean effective pressure. This is occasioned by poor atomization (in engines ignited by incandescence it is usually particularly bad), by the incomplete utilization of the air, and by the increased ratio of piston velocity to ignition velocity.

The lecturer then alluded to the importance of the question of ignition velocity, which plays an important part in the case of high speed engines in particular, and which is as yet insufficiently understood. The well-known researches made at Dresden, by Nagel, Neumann and Nusselt, in burning cold mixtures in a bomb should be extended to as many different fuels as possible. Fig. 6 shows the ignition velocities of various fuel mixtures, set down in terms of the colorific values of the fuel contained in the cubic meter of the mixture, on the basis of Nagel and Neumann's measurements. The values are, like Holm s measurements, most instructive as comparative values. The ignition velocity of the hot mixture in the engine itself is far higher. The so-called limits of the ignition of different fuels (according to Eitner) are also given in Fig. 6. They accord fairly well with the ignition limits obtained in the bomb. The calorific values of mixture ratios giving rise to the greatest development of heat in the engine and to the maximum value for the formation of CO_2 are important. This thermal value varies from 700 to 900 gram calories per cubic meter (45 to 59 B.t.u. per cubic inch), according to the heating value and the amount of air required by the fuel; it is a decisive factor in determining the highest possible mean effective pressure (see equation 3) and consequently of the maximum power of an engine with the fuel in question. As the ratio of air to fuel increases, the ignition velocity first increases slowly, then, in the case of some few fuels, as for instance, ordinary gas, it increases rapidly; in other cases, especially with gasoline and benzol, it falls slowly. For the engine, however, the ignition velocity must not be too low, lest after-burning and delaying explosion take place; nor must it be too high, lest the rapid combustion give rise to too violent explosions. With increasing piston velocities, it must,

(Continued on page 22)

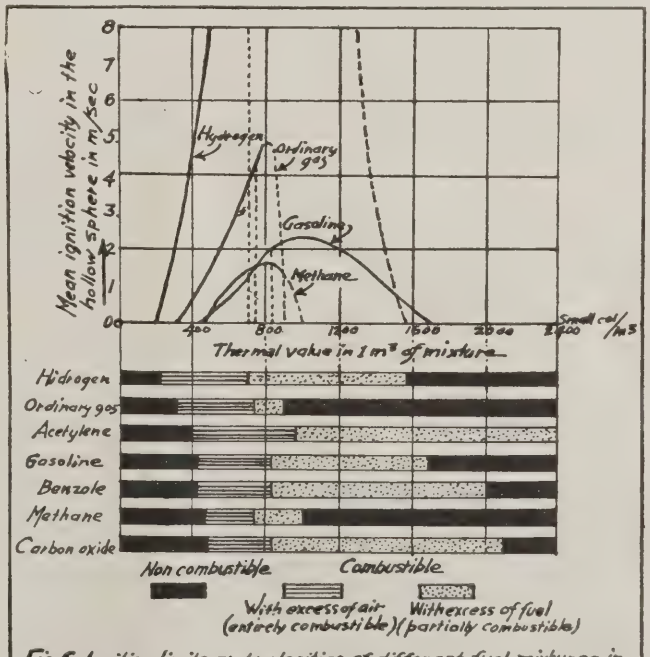


Fig. 6. Ignition limits and velocities of different fuel mixtures in a closed chamber (in terms of the thermal value of the fuel in 1 m³ of mixture).

[11] See Dr. Holm's article in the "Zeitschrift f. angew. Chemie" (Journal of Applied Chemistry, 1913, p. 273.)
[12] See Proceedings of the Institution of Civil Engineers, 1909.

THE EMPLOYMENT OF AIRSHIPS FOR THE TRANSPORT OF PASSENGERS

Indications on the Maximum Limits of Their Useful Load, Distance Covered, Altitude and Speed*

By UMBERTO NOBILE

Director of Italian Aeronautical Construction

(Concluded from last issue)

10.—Maneuvering Devices

The total weight of these devices, and especially of the cables, evidently varies in proportion to $V^{4/3}$.

In point of fact, while the forces are proportional to V, the length of the cables is proportional to $V^{1/3}$.

In our case we have:

$$0.00060 \cdot V^{4/3}$$

11.—Lighting Plant, Wireless Plant, Etc.

The equipment of the airship is completed by the lighting plant, wireless installation, ventilators, safety appliances, signals, and other minor accessories.

Of these weights some, such as that of the wireless installation, may be assumed to increase slightly with the cubature of the airship (in fact, it is probable that a wider range of wireless will be required for larger airships). Other accessories, such as the lighting plant, increase in proportion to $V^{2/3}$; others, as the ventilators and safety appliances, increase in the same ratio as the cubature.

In the case of our model we have:

$$4.5\ V^{1/3} + 0.19\ V^{2/3} + 0.007\ V$$

12.—Pilot's Cabin

The pilot's cabin is provided with all the instruments required for navigation and with other necessary equipment.

It is difficult to give a definite ratio of the variation of the weight with the cubature.

To simplify matters we will assume that the area of the cabin is proportional to $V^{1/3}$ and that the total load also increases in proportion to $V^{1/3}$. We then conclude that the total weight varies in proportion to $V^{2/3}$. In our case: $0.300\ V^{2/3}$.

13.—Passenger Cabins

It is not possible to determine a priori the weight of the passenger cabins and their equipment, since this must evidently be proportional to the number of passengers carried. We can, however, include this weight in the useful load by adding 20 to 25 kg. per passenger.

14.—Benzine, Oil, and Water Tanks

The weight of these tanks, comprising their supports, amounts to about 6% of the weight of the liquid contained therein.

The weight of the water tanks can be counted in with the weight of the ballast, and we will reckon the weight of the benzine and oil tanks by adding 6% to the weight of the benzine and oil needed per kilometer.

We have now evaluated the entire weight of the airship itself. In order to consider the airship in flying shape, we must add the weight of the crew, spare parts, reserve ballast, ballast needed for take off, and the weight of fuel and oil.

15.—The Crew

The number of men forming the crew depends not only on the cubature of the airship, but also on other circumstances which are not possible to account for a priori, and we will therefore be satisfied with a rough approximation.

The minimum crew needed consists of:

1 Commander	1 Mechanic
1 Pilot	1 Wireless operator.

With increased cubature of the airship, we may, generally speaking, assume that the journeys undertaken will be longer and more fatiguing, and that, therefore, double shifts will have to be provided for.

We are, therefore, justified in assuming that the weight of a minimum personnel will be in proportion to $V^{1/3}$.

The total number of mechanics, less the one included in the minimum crew, may be roughly considered as proportional to the power, that is, to $V^{2/3}v^3$.

There are also the all-around men who, though not required on a small airship, are certainly indispensable on a large one. The weight of these may be taken as proportional to the cubature of the airship.

In the case of our model, including also the weight of clothes and food reserves, we have:

$$20\ V^{1/3} + 10^{-6} \cdot 0.20 \cdot V^{2/3}v^3 + 0.003 \cdot V$$

16.—Spare Parts for the Engine Set and Tools

This weight may be taken as proportional to the engine power. In our case it is given by:

$$10^{-6} \cdot 0.16 \cdot V^{2/3}v^3$$

17.—Reserve Ballast and Take Off Ballast

As we said at the beginning, we shall suppose that navigation is normally started at an altitude of about 300 m. above sea level. The corresponding lightening of the airship will be approximately given by 0.030 V.

The reserve ballast may also be taken as proportional to the cubature and we may say that its weight in kg. is numerically expressed by 4% of the volume expressed in cubic meters.

The total weight of the ballast is thus expressed by:

$$0.030\ V + 0.040\ V = 0.070\ V$$

18.—Reserve Stock of Fuel and Oil

It is logical, we believe, that, in order to ensure safe navigation, the reserve stock of fuel and oil carried must be large enough to meet all eventualities. This reserve must be in proportion to the amount required for normal navigation. We will calculate this by increasing by 30% the usual consumption per kilometer, or, which amounts to the same thing, the specific consumption per h.p.

19.—General Formula for the Useful Lifting Force

Establishing, as we did at the beginning, the approximate laws governing the variation in the weights of the airship, the armament, and the crew, we find that the total weight, P, of the airship ready for navigation (except the passenger cabins, the benzine and oil tanks, and the reserve stock of benzine and oil) is expressed in function of the cubature and of the velocity by six terms respectively proportional to

$$V^{1/3},\ V^{2/3},\ v^3V^{2/3},\ V,\ V^2V,\ V^{4/3}$$

In Table I (see at the end of this paper) the numerical coefficients of these terms are summarized, and from that table we derive the following expression for P:

$$(2)\quad P = 24.5\ V^{1/3} + (3.274 + 10^{-6}\ 3.51\ v^3)\ V^{2/3} + + (0.160 + 10^{-6}\ 3.1\ v^2)\ V + 0.0067\ V^{4/3}$$

in which V is expressed in cubic meters, v in km/h and P in kg.

V is the maximum effective volume of the gas bag after inflation.

If we subtract the weight P from the total lifting force at the sea level, f V*, we shall obtain the lifting force of which we can dispose for the useful load and for the provision of benzine and oil needed for navigation. We will call this the USEFUL lifting force and will represent it by Φ.

We should recall once more:

1st. That the useful load comprises not only the weight of the passengers, their baggage and food supplies, but also the weight of the cabins suitably fitted up for the number of passengers that can be carried.

2nd. That in the provision of benzine and oil is included not only that required for normal navigation, but also a proper quantity of reserve stock together with the tanks required for holding the entire provision.

Putting formula (2) in the general form:

$$(2^1)\quad P = \alpha V^{1/3} + \beta V^{2/3} + \gamma V \div \delta V^{4/3}$$

we obtain for Φ

$$(3)\quad \Phi = f V - (\alpha V^{1/3} + \beta V^{2/3} + \gamma V + \delta V^{4/3})$$

This formula shows that there are two values of V for which $\Phi = O$, one very small, the other very large. Passing from the first to the second value, the useful lifting force first increases, then, after reaching a maximum value, decreases until it again equals zero.

The value of V, which corresponds to Φ maximum, is obtained by extracting the value of V from furmula (3) and making it equal to zero:

$$(4)\quad f V = \tfrac{1}{3}\ \alpha V^{1/3} + \tfrac{2}{3}\ \beta V^{2/3} + \gamma V + \tfrac{4}{3}\ \delta V^{4/3}$$

20.—Variations of the Coefficient of Utilization in Function of the Cubature and Velocity. Limit Regimes of Flight

We will call "Coefficient of Utilization" the ratio ρ between the useful lifting force and the total lifting force:

*In our calculations for f we shall assume the mean value of 1100 kg. per cubic meter of gas.

$$(5)\quad \rho = \frac{\Phi}{f\,V} = 1 - \frac{1}{f}\,(\alpha\,V^{-2/3} + \beta\,V^{-1/3} + \gamma + \delta\,V^{1/3})$$

Here also, starting from a minimum value of V, for which $\rho = 0$, the value of ρ increases rapidly with the increase of cubature until it reaches a maximum. After reaching this maximum, the value of ρ decreases slowly down to zero again for a rather large value of V.

The values of V for which $\rho = 0$ (lower and upper limits of cubature) are obtained from the following equation:

$$(6)\quad f\,V = \alpha\,V^{1/3} + \beta\,V^{2/3} + \gamma\,V + \delta\,V^{4/3}$$

and, of course, the lower limit is higher as the velocity is lower. In fact, in this case the coefficients β and γ are small also, and we have:

$$\beta = \beta' + \beta''\,v^3$$
$$\gamma = \gamma' + \gamma''\,v^2$$

In the case of our model we find for these lower limits of V the following values*:

at 90 km/h V = ∽ 1,000
at 120 km/h V = ∽ 2,300
at 150 km/h V = ∽ 13,000

The maximum value of β is found by the following equation:

$$\delta\,V^{4/3} = 2\,\alpha\,V^{1/3} + V^{2/3}$$

from which, neglecting the first term of the second member, we obtain as a rough approximation:

$$V^{2/3} = \backsim \frac{\delta}{\beta} = \frac{\beta' + \beta''v^3}{\delta}$$

We may therefore conclude that *with increase of velocity maximum diminishes and tends towards larger cubature.*

As a matter of fact, in our case we find the following values (see Tables II, III, IV, and diagrams):

at 90 km/h max. = 0.450 for V = 35,000 m.³
at 120 km/h max. = 0.345 for V = 60,000 m.³
at 150 km/h max. = 0.202 for V = 125,000 m.³

We would remark here that, contrary to the current opinion, the maximum values of the coefficient of utilization are to be found for relatively small cubatures.

The upper limit regime of flight to which the airship can steadily lift itself (assuming that there is no change in equilibrium between the internal and external temperature) is that for which the corresponding value of the air density is in the same ratio to the density of the air at sea level as P to f V. This limit thus depends essentially on the value of ρ.

Considering the mean conditions of temperature and atmospheric pressure, and assuming a constant difference of temperature of 0.0055 centigrades per meter, we find the following values which have been computed taking into account also the first 300 meters elevation:

for $\rho = 0.20$ H max. = 2430 m. above sea level.
for $\rho = 0.25$ H max. = 3050 m. above sea level.
for $\rho = 0.30$ H max. = 3700 m. above sea level.
for $\rho = 0.35$ H max. = 4380 m. above sea level.
for $\rho = 0.40$ H max. = 5120 m. above sea level.
for $\rho = 0.45$ H max. = 5870 m. above sea level.
for $\rho = 0.55$ H max. = 6700 m. above sea level.

and in the case of our model, corresponding to the values of ρ max. given above, we find:

at 90 km/h V = 35,000 H max. = 5870 m.
at 120 km/h V = 60,000 H max. = 4260 m.
at 150 km/h V = 125,000 H max. = 2450 m.

21.—Optimum Cubature. Consumption Per Kilometer

For the balloon the optimum cubature is evidently given by the maximum value of the coefficient of utilization.

As a matter of fact, for ρ max. the useful load is raised to a given height which is maximum, and the altitude to which a given useful load can be raised is also maximum.

But in the case of an airship it is evident that we must take into account the maximum distance over which a given useful load can be carried.

If we call p_u the lifting force per cubic meter required for the useful load, and c the supply of benzine and oil required per kilometer, we shall be able to measure the *unit velocity* of the airship by:

$$\epsilon = \frac{f\rho - p_u}{c}$$

which represents the maximum distance L over which the load p_u can be carried.

As we must first establish a value of p, we will take that which gives the maximum value of L x p_u. This maximum is evidently obtained when the useful lifting force, ρ f, is equally distributed between the useful load and the supply of fuel and oil. We will therefore assume as the ratio of the unit efficiency of the airship, the value:

$$(7)\quad \epsilon = 0.55\,\frac{\rho}{c}$$

We will now determine the value of c in the hypothesis that *the normal velocity of navigation,* v_o, *is obtained by utilizing half of the available power,* that is:

$$N_o = \frac{1}{2}\,\frac{k}{\pi}\,V^{2/3}v^3$$

We shall then have:

$$v_o = 0.794\,v$$

and therefore:

$$\frac{N_o}{v_o} = \frac{k}{\eta}\,\frac{V^{2/3}v^2}{1.588}$$

We will assume that the engine plant consumes about 250 grs. of benzine and oil per h.p./h. In order to calculate the total supply of benzine and oil needed, we will add 30% to the normal consumption, and in order to calculate the total weight we must also take into account the weights of the containers which we have evaluated at 6% of the total weight of fuel and oil. We shall then have per h.p./h. a weight of

$$(0.250 + 0.075) \times 1.06 = 0.345 \text{ kg.}$$

and therefore the total weight per kilometer will be given by:

$$c = 0.345\,\frac{N_o}{v_o}$$

and assuming for $\frac{k}{\pi}$ the value 10^{-6} 1.5 we obtain:

$$(8)\quad c = 10^{-9} \times 326 \times V^{2/3}v^2$$

and substituting in the expression of ϵ:

$$(9)\quad \epsilon = \frac{10^9}{593}\cdot\frac{\rho}{V^{2/3}v^2} = a\,\frac{\rho}{V^{2/3}v^2}$$

The *optimum cubature* is that for which ϵ assumes its maximum value. It is obtained by solving the following equation:

$$(10)\quad 2\,(f - \gamma)\,V = 4\,\alpha\,V^{1/3} + 3\,\beta\,V^{2/3} + \delta\,V^{4/3}$$

We should not be surprised that we find some very low values. In fact it is evident that the optimum cubature must always be less than the one corresponding to the maximum value of ρ, because for larger cubatures the denominator of ϵ increases, while the numerator decreases.

In our case we find:

for 90 kw/h. : optimum cubature = ∽ 5,000
for 120 km/h. : optimum cubature = ∽ 10,000
for 150 km/h. : optimum cubature = ∽ 30,000

If we now consider the velocity only as variable, it is obvious that efficiency diminishes with the increase of velocity, that is, there does not exist an *optimum value of velocity* outside of zero for which efficiency becomes maximum. And in fact if in $\frac{o}{V^{2/3}v^3}$ we express the coefficients β and γ in function of the velocity:

$$\beta = \beta' + \beta''\,v^3 = 3.274 + 10^{-6}\,3.51\,v^3$$
$$\gamma = \gamma' + \gamma''\,v^2 = 0.160 + 10^{-6}\,3.10\,v^2$$

and then make:

$$\frac{d}{dv}\left(\frac{\rho}{V^{2/3}v^3}\right) = 0$$

we find:

$$v^3 = -\frac{(f - \gamma')\,V^{1/3} - \alpha\,V^{-1/3} - \delta\,V^{2/3} - \beta'}{2\,\beta''}$$

which, for greater clearness, we may write:

$$v^3 = -\frac{f\,V - (\alpha\,V^{1/3} + \beta'\,V^{2/3} + \gamma'\,V + \delta\,V^{4/3})}{2\,.\,\beta''\,V^{2/3}}$$

from which we see that the existence of an optimum value of the velocity difference from zero is contingent on the condition:

$$f\,V < \alpha\,V^{1/3} + \beta'\,V^{2/3} + \gamma'\,V + \delta\,V^{4/3}$$

which can never be attained because we should also have:

$$f\,V < P$$

22.—Cubature of Minimum Consumption. Distance Limits

When we come to consider the efficiency of the airship solely from a mechanical point of view, we find that for each

*Regarding the possibility of practically realizing these minimum values of cubature, the reservations and observations made at the beginning of this study apply here also.

velocity there is a certain cubature which permits of carrying the unit of useful weight to the unit of distance with a minimum expenditure of energy, that is, with a minimum consumption of fuel.

Let P_u be the maximum useful load which an airship can carry to a distance L. The consumption of fuel per kilogrammeter will be given by:

$$\frac{c\,L}{P_u L} = \frac{c}{P_u}$$

We will assume, as before, that the useful lifting force is equally distributed between the useful load and the supply of fuel and oil in such a way as to give $P_u L$ its maximum value.

In such a case the consumption per kgm. will be proportional to:

$$\frac{c}{\Phi}$$

that is, in inverse proportion to the maximum distance which the airship can cover without any useful load. We will call this distance the *"limit distance."*

It is evident that there exists a value of V for which the unit consumption is minimum and therefore the distance limit is maximum. In fact, we have only to consider that if the cubature increases indefinitely, the useful lifting force will finally reach zero, while c always has a positive value.

We will determine the value of this *cubature of minimum consumption,* which we may also call the *cubature of maximum range.*

Keeping in mind formulas (3) and (8) we can put:

$$(11)\quad L_{max.} = \frac{\Phi}{c} \cdot \frac{f\,V - (\alpha V^{1/3} + \beta V^{2/3} + \gamma V + \delta V^{4/3})}{10^{-9} \cdot 326 \cdot V^{2/3} v^2}$$

Solving this equation for the volume and taking it as equal to zero we find:

$$(12)\quad f\,V + \alpha V^{1/3} - \gamma V - 2\,\delta V^{4/3} = 0$$

an equation which, solved for V, gives the value of the cubature of minimum consumption.

This value being very high, the terms $\alpha V^{1/3}$ may be considered as negligible, and then we have only:

$$(13)\quad V = \sqrt[3]{\frac{f-\gamma}{2\,\delta}}$$

a result which may be enuciated thus: *The linear dimensions of the airship of minimum consumption vary linearly with the coefficient γ and therefore with the square of the velocity and increase as the velocity diminishes.*

In point of fact, having, for our model:

for 90 km/h	$f - \gamma = 0.915$
for 120 km/h	$f - \gamma = 0.896$
for 150 km/h	$f - \gamma = 0.870$

and $2\,\delta = 0.0134$, we find:

for 90 km/h	:	cubature of min. cons. $= \backsim 318000 m^3$
for 120 km/h	:	cubature of min. cons. $= \backsim 299000 m^3$
for 150 km/h	:	cubature of min. cons. $= \backsim 274000 m^3$

23.—Limit Velocity

For each cubature, the airship is designed for reaching a certain maximum velocity which cannot be exceeded. This limit vaule is at once obtained by solving for w the equation: $P = f\,V$.

Taking as a basis the expressions of P given by formula (2) we find, for our model, the following values:

V = 1,000 m³	Velocity limit = 92.5 km/h
V = 5,000 m³	Velocity limit = 133 km/h
V = 10,000 m³	Velocity limit = 148 km/h
V = 50,000 m³	Velocity limit = 173 km/h
V = 100,000 m³	Velocity limit = 181 km/h
V = 300,000 m³	Velocity limit = 185 km/h
V = 300,000 m³	Velocity limit = 185 km/h
V = 400,000 m³	Velocity limit = 178 km/h

As we see, the limit velocity first increases rapidly with the increase of cubature, then, after reaching a maximum of 185 km/h. for a cubature of from 200,000 to 300,000 cubic meters, slowly decreases.

In practice, of course, these values of absolute maximum of velocity should not be reached; in fact, they should not even be approached.

24.—Influence of the Coefficient of Resistance and of Propeller Efficiency

In the general expression of P given in formula (2') the only term which depends on the power, and therefore on the coefficient of resistance k as well as on the propeller efficiency η, is

$$\beta V^{2/3} = (\beta' + \beta'' v^3)\, V^{2/3}$$

β being proportional to N and consequently also to $\frac{k}{\eta}$.

It is therefore easy to see the effects produced by a variation of the ratio $\frac{k}{\eta}$.

As regards the coefficient of utilization ρ, of course it increases as $\frac{k}{\eta}$ diminishes and vice versa. More exactly, we may say that, for a given cubature, the variation follows a linear law, as is shown by the general expression for ρ. We may add that the variation is more rapid for small cubatures, for which the term $\beta V^{2/3}$ acquires greater importance with respect to the other terms.

The approximate expression $V^{2/3} = \frac{\beta}{\delta}$ which gives the cubature corresponding to ρ maximum, thus shows that with increase of $\frac{k}{\eta}$, ρ maximum is obtained for a larger cubature, and when $\frac{k}{\eta}$ decreases, ρ maximum tends towards a smaller cubature.

The *cubature of minimum consumption or maximum range* remains unchanged. This is clearly shown by formula (13) in which V is independent of β.

On the other hand, we have notable variations in the distance limit given by formula (11). Indicating by A a numerical coefficient, this may be put in the following form:

$$L_{max} = \frac{f\,V - (\alpha V^{1/3} + \beta V^{2/3} + \gamma V + \delta V^{4/3})}{A \frac{k}{\eta} V^{2/3} \cdot v^3}$$

and from this it clearly results that when $\frac{k}{\eta}$ increases, the numerator decreases and, at the same time, the denominator increases, and therefore L_{max} decreases. On the other hand, when $\frac{k}{\eta}$ decreases, the numerator increases and the denominator decreases, that is to say, L_{max} increases.

Finally, the limit velocity also varies with $\frac{k}{\eta}$, increasing as $\frac{k}{\eta}$ decreases.

25.—Variations of the Limits of Distance and Velocity for Small Variations of Volume

In order to show more clearly the influence of the increase of velocity and range on the cost of operation of aerial transport, we will consider a difference in volume sufficiently small to enable us to assume that for all intermediate cubatures the coefficient of utilization, ρ, remains just about constant. This we can always do, even for rather large differences in volume, when, for instance, we consider the region of the maximum value of ρ.

The distance limit, in the above hypothesis is given by:

$$L_{max} = \frac{\rho V}{A \frac{k}{\eta} V^{2/3} v^2} = \frac{\rho V^{1/3}}{A v^2} \cdot \frac{\eta}{k}$$

and therefore

$$(14)\quad V = \frac{A\,k}{\rho\,\eta} v^6 L^3_{max}$$

from which we may conclude that for small variations in volume, the volume is proportional to the cube of the ratio $\frac{k}{\eta}$, to the sixth power of the velocity and to the cube of the distance. This last result may also be enunciated in a suggestive form as follows: *The length of the airship is proportional to the maximum distance that it can cover.*

Thus, for instance, in order to increase the distance limit by only 10%, we must increase the volume by 33%, and if we wish to increase the velocity by only 5%, the cubature must be increased by 35%.

Of course the results are even more unfavorable if, in the differences of volume considered, the value of ρ decreases, as is the case when this difference is on the right hand side of the cubature for which ρ is maximum.

(*To be continued*)

NAVAL and MILITARY AERONAUTICS

Navy Blimp Destroyed

Twenty minutes before she was to have started for the hangar at Lakehurst, N. J., the naval balloon D-6, the largest and newest non-rigid dirigible possessed by the navy, burned, with her hangar and three other balloons, at the Rockaway Point Naval Air Station August 31.

No lives were lost, but Machinist's Mate Donald B. MacKay, in the car when the fire started, was severely burned.

The D-6 was fully inflated and contained about 190,000 cubic feet of hydrogen gas. The other balloons, not inflated, were the kite balloon A-P and two small dirigibles, the C-10 and the H-1.

A board of investigation was immediately appointed by Commander F. H. Strong, and after a three-hour conference, in which all members of the crew of the D-6 were questioned, a report was forwarded to Admiral Moffett, in charge of the Bureau of Naval Aviation in Washington. Commander Strong would not make public the results of the investigation.

It was thought that gasoline fumes from a leaky fuel pipe may have been ignited by a spark from a hammer. A new tank had been installed and mechanics were busy connecting up the feed pipe.

Lieutenant Charles E. Bausch, who was to command the crew of seven men, had just ordered them to get their luggage when he saw flames shooting toward the gas bag. He ordered every man out of the hangar and turned in an alarm which brought all of the 250 men at the station.

The reserve hydrogen tank, containing about 50,000 cubic feet of gas, a steel structure of the cylindrical type, standing 100 feet from the hangar, was used as a vantage point from which the sailors turned streams on the burning hangar and nearby buildings, keeping the sides and top of the tank under two streams of water. Lieutenant Kloor and Commander Strong led the sailors. Their forces were supplemented by fire companies from the Rockaway Park station, and soldiers hurried over from Fort Tilden.

The combined forces kept a water barrage going for more than an hour on all sides of the burning hangar. A stiff breeze was blowing off shore and threatened for a time to carry the fire to the barracks, the Naval Hospital and storehouses and across the dry grass to cottages along the shore.

The D-6 was 200 feet long and fifty feet in diameter fully inflated. She was propelled by two 125-horsepower Union type motors, and could make fifty-five miles an hour. She had a lifting power of about ten tons. The D-6 carried 200 gallons of gasoline and had a cruising radius of 1,000 miles. She was assembled at the Rockaway Point Station under the direction of Lieutenant Bausch.

The gondola and engines were built at the League Island Navy Yard in Philadelphia and the balloon was made at the navy balloon plant in Akron, Ohio. The D-6 was equipped with the limousine type of gondola, completely enclosed, which made it possible, the authorities believe, for the men in the hangar to escape before the balloon ignited. The trip to Lakehurst would have been her maiden voyage, although she had been taken for several short test spins over Jamaica Bay and Coney Island.

The Navy Department has under way plans for several other ships of the D-6 type.

Aerial Planes to be Used in Alabama Attack

New weapons of aerial warfare will be given an initial test when the army air service conducts its next bombing operation—a night attack on the old battleship Alabama. The plan is to stage the attack about September 15, probably at the scene of the recent tests upon the former German craft, off the Virginia Capes.

A "light barrage," composed of giant aerial flares, each of more than 200,000 candle power, will be one feature of the attack. Army engineers have submitted such enthusiastic reports on this weapon that larger flares, estimated to be equal to 1,000,000 candles, have been placed under construction.

Giving a greenish-white light, literally "brighter than day," the flares to be used in the Alabama test will illuminate an area of five square miles and, expert flyers say, should enable the aviators to obtain greater accuracy than in the daytime. The flares are attached to a parachute of white silk, which reflects the light downward with sufficient intensity, it is believed, to blind the officers and gunners on the ship under attack, so as to demoralize any plan for defense, while keeping the upper air reaches shrouded in gloom.

Just before the armistice was signed flares of 200,000 candle power were perfected by the ordnance branch of the Army Air Service. They were equipped with eighteen-foot parachutes, which kept them aloft while the magnesium burned for a period of from seven to eleven minutes. No opportunity was afforded for a test against the enemy, however.

Although disappointed that they cannot have the Alabama equipped for battle with radio control, as they hoped, the army flyers are exerting every effort to conduct the bombing tests with war conditions as nearly simulated as possible.

It will not be the object of the army pilots to see how quickly they can sink the Alabama, but rather to try out special gas and non-extinguishable phosphorous bombs on her, as well as to ascertain the effect of small demolition bombs. Bombs up to 4,000 pounds each may be used.

The Alabama is at Philadelphia and practically ready for delivery to the air service.

Personal Paragraphs

Lt. L. W. Miller has been appointed Assistant Commandant and Officer in Charge of Training of the Photographic School at Langley Field, relieving Lt. James P. Hodges.

Captain Hal. T. Vigor, Q. M. C., has reported for duty at Langley Field, having been assigned to duty as Quartermaster. Lt. Glenn D. Gorton has been detailed as assistant to the Quartermaster.

Changes in Station of Air Service Officers

1st Lieut. Wm. J. Flood has been relieved from duty at Ross Field, Arcadia, California, and assigned for duty with the 8th Airship Company at Camp Bierne, Texas.

Lieut.-Colonel C. C. Culver has been assigned as student officer at the General Staff College for the 1921-1922 course.

1st Lieut. George E. Hodge has been relieved from duty at Fort Sam Houston, Texas, and assigned to duty in the Office of the Chief of Air Service, Washington, D. C.

Captain Arthur R. Brooks relieved from duty at Ellington Field, Texas, and assigned to Langley Field, Va., for duty.

1st Lieut. Clayton C. Shangraw relieved from duty at Bolling Field and ordered to Carlstrom Field, Arcadia, Fla., for duty and pilot training.

Captain Benjamin G. Giles relieved from duty at Post Field, Fort Sill, Okla., and assigned to Carlstrom Field, Arcadia, Fla., for duty and pilot training.

Major Leo A. Walton, Air Service, relieved from duty at the Field Officers' School at Langley Field, Va., and ordered to Washington, D. C., for duty in the Office of the Chief of Air Service.

1st Lieut. F. P. Kenney transferred from the Montgomery Air Intermediate Depot at Fairfield Air Intermediate Depot, Fairfield, Ohio, for duty.

1st Lieut. Wm. C. Sinclair, Infantry, detailed to the Air Service, and ordered to proceed from Camp Sherman, Ohio, to Carlstrom Field, Arcadia, Fla., for duty and pilot training.

1st Lieut. Earl J. Carpenter, Air Service, relieved from duty at Middletown Air Intermediate Depot and assigned to duty at Bolling Field, Anacostia, D. C., for duty.

1st Lieut. John E. Lynch, Air Service, relieved from duty at Kelly Field, San Antonio, Texas, and ordered to proceed to Washington, D. C., for duty in the Office of the Chief of Air Service.

Captain Horace N. Heisen relieved from duty in the Office of the Chief of Air Service, Washington, D. C., and directed to proceed to Langley Field, Va., as student officer at the Field Officers' School.

1st Lieutenants Frank M. Bartlett, Alonzo M. Drake and Clarence E. Crumrine have been relieved from duty in the Office of the Chief of Air Service, Washington, D. C., the first named to proceed to Chanute Field, Rantoul, Ill., for duty and the two last named to Mitchel Field, L. I., New York, for duty.

Major Maxwell Kirby has been relieved from duty in the Office of the Chief of Air Service and assigned as Corps Area Officer at Fort Benjamin Harrison, Indiana.

1st Lieut. Phillip Schneeberger relieved from duty in the Office of the Chief of Air Service and upon completion of leave of absence granted him will proceed to McCook Field, Dayton, Ohio, for duty.

FOREIGN NEWS

New South American Altitude Mark

Eduardo Olivero, an Argentine airman, who served in the Italian Army during the war, where he attained the rank of Captain and won five medals, has just set a new South American flying record for altitude by attaining a height of 26,240 feet. He may have gone higher, for 8,000 meters was the most the instrument would register, and Olivero lost consciousness for some time on reaching this height. The record height was reached in one hour and fifteen minutes. The flight was made in exceptionally cold weather.

Aeroplanes and the Canadian Oil Fields

The Imperial Oil Company of Canada has adopted up-to-date methods in "beating others to it" to the oil fields in the vicinity of Fort Norman. A party of four, consisting of the pilot, mechanic, a surveyor and a geologist, flying over miles upon miles of untenanted and practically unexplored sub-arctic lands, recently made a journey in a JL-6 all-metal aeroplane owned by this company from Peace River, Alberta, to Fort Norman, Mackenzie River District, N. W. T., a distance of approximately 1,400 miles by river and lake, in 13 hours and 40 minutes actual flying time. The machine flew on the average around 80 miles an hour, although on occasions with wind on her tail it made bursts of speed reaching to 100 miles per hour. When the aircraft began approaching the foothills of the Rocky Mountains, which run down to the Mackenzie River at the mouth of the Nehami, the scenery from aloft was impressive beyond description. Prior to this a snowstorm was encountered at Wrigley Harbor, but the plane shot through it without pausing. The tributaries of the Mackenzie River, winding away up into their sources in the mountains, thousands of lakes, large and small, and streams were spread out before the vision of the airmen like a map.

By the time the site of Old Fort Norman was reached the plane was flying at an altitude of 4,000 feet, and through the clear atmosphere could be seen the ice shining on the surface of Great Bear Lake, 75 miles to the northeast, and the gorge of the Great Bear River through the Franklin Mountains.

One notable feature of the journey was the making of a forced landing between the far North Forts of Simpson and Wrigley on the surface of the Mackenzie River. The only one around to help the crew in departing was an Indian who had been attracted by the descent of the great bird. It would be difficult to imagine the amazement of this aborigine at seeing this plane hurtling down the river and then rising aloft into the air again.

On landing at Fort Norman the machine crashed, shattering one of its pontoons and one wing. This accident, it was explained, was due to the extremely smooth and mirror-like surface of the water, which made it impossible to calculate accurately the height of the machine above the river.

The surveyor and geologist, immediately upon landing, proceeded with a party of men to stake claims.

Flying Very Popular in Britain

Taking flights in aeroplanes in Great Britain appears to be no more thought of than taking a ride in an automobile or a street car. Messrs. J. V. Holmes and O. R. Jones, two veterans of the World War, in charge of an Avro aeroplane, have visited various towns and cities in England and Scotland, and judging from the large number of people they have taken up for flights they are doing a land office business and will soon be rolling in wealth. At Dumfries, the first place visited in Scotland, no fewer than 1,050 persons went up in the ten days of their visit. At Annan where they stayed five days 400 people took flights, and at Lanimer 300 people sailed heavenwards for a brief space. Upwards of 15,000 people have been taken up at one time and another by these airmen, and no untoward mishap has occurred.

Interesting Flight in Peru

Lt. Lloyd Moore, chief pilot for the Compañia Nacional Aeronautica, made a very interesting flight from Lima to Huraz, a distance of over six hundred miles over the Andes.

The trip from Lima to Huraz was most interesting. They left the field in Bellevista in a very heavy fog which caused them to climb to an elevation of 15,000 feet. Then taking their course by compass, they continued, but upon reaching the vicinity of Huraz the clouds were so dense that they could not see to make a landing. They could do nothing but fly until they found a spot clear and a place to land. They did this at the end of a flight of two hours and a half, landing on the shelf of a mountain, at an elevation of 12,600 feet, two kilometers from Mollepata. Upon landing they saw some natives running to hide. At the end of an hour they succeeded in getting one of them near enough to make them understand that they wanted to know where they were. In the meantime other Indians had run to the village, and going to the office of the alcalde, told him that a large condor had landed and that two men had climbed from its back. They were received like kings in the town, runners were sent to a near ranch for gasoline, and they continued their trip the following day.

On the trip from Mollepata to Huraz they came into a strong upward current. When they passed "Huascaran," the highest peak of the Andes, which has an altitude of 26,420 feet, the machine attained an altitude of 25,000 feet. They made two turns around this peak, on the second turn having an altitude of 28,600, the people of Huraz watching the flight.

Mrs. Peck, the woman mountain climber, in her book of her fight in climbing Huascaran, does not speak of lakes on the top. Lt. Moore states that there are three lakes on the top, and the papers of Lima now question the fact that Mrs. Peck ever reached the top.

The flight home was without incident. The flight was made in an S V A No. 10, with the SPA motor.

Gabriel Voisin Killed

The famous French aviator Gabriel Voisin lost his life and caused the death of a passenger as the result of flying low enough to shout a message to his brother-in-law that he was coming back for dinner.

Voisin had just started for an aerial promenade with a friend. He turned back toward the villa outside of Juvisy where he was staying, and when he arrived within earshot of his brother-in-law standing in the garden, shouted: "Wait with dinner for us."

But he had cut off the engine and the machine failed to clear a hedge and crashed. Both pilot and passenger were killed.

Competition for Aircraft Safety Tanks

The British Air Ministry announces:-

The possibility of aircraft catching fire in the air has been almost entirely eliminated by care in design and inspection, but such precautions are not sufficient to protect, in every case, an aeroplane from the results of a crash.

One of the main objects still to be attained is to ensure that in a heavy landing or a crash the fuel tanks on an aircraft, even though seriously damaged, will withstand the shock to which they may be subjected without either bursting or leaking.

Accordingly, with the object of obtaining for use in Service and Commercial aircraft safety tanks which will fulfill these conditions and which will at the same time withstand the effects of enemy action by machine gun and shell fire a competition for safety fuel tanks has been arranged to commence on December 1, 1921.

Prizes to the extent of £2,000 will be awarded to the entrants of the tanks which are considered best. The first prize will be £1,400, the second £400 and the third £200.

The competition will be held at a place which will be decided upon later.

Any competitor may enter several different types of tanks, but two specimens of each type must be supplied for preliminary tests and four for the final tests. Entries, which should be addressed to the Secretary (R. D. I.) Air Ministry, Kingsway, London, W. C. 2., marked "Safety Fuel Tank Competition," will be received until November 7, 1921. These should be made on a form which will be supplied on request.

The control of the competition will be in the hands of a judges' committee appointed by the Air Council. Their decision as to awards shall be final and without appeal.

Tanks should be constructed so as to prevent as far as possible leakage or ignition of fuel when subjected to stresses similar to those to which the tank would be subjected in an aircraft crash, and to machine gun fire using incendiary, armour piercing, or explosive ammunition. Equal importance is attached to these requirements.

A tank is to be capable of being fitted within a space of 2 feet 6 inches by 2 feet by 2 feet and to have a capacity which must be within 5 per cent. of 30 gallons, but any shape of tank will be accepted for competition. All the necessary fittings to enable the tank to be mounted in a structure for testing purposes must be supplied by the competitor.

The maximum weight, which would only be justified by very exceptional qualities, should not exceed 1.75 lb. complete with fittings per gallon capacity. Tanks exceeding this figure will not be disqualified, but great importance will be attached to low weight.

In all cases the tank is to be complete with the necessary fittings to enable it to perform its functions of supplying fuel to a fixed point.

In the case of tanks designed to incorporate leak detectors and similar instruments and devices, these will be fitted in such a manner as to show their efficiency under test, and will be included in the weight. In every case there must be at least one filled and also unions for supply and delivery connections, one of the latter at the top, the other at the bottom of the tank.

The relative importance of other characteristics of the tanks will be considered in the following order:—Light weight, durability under service conditions in the absence of any accident, indifference to extremes of temperature, adaptability of design to large capacities, simplicity of construction, adaptability of design to various shapes, accessibility of fittings, cost of production.

All tanks will be submitted to preliminary trials. The three best types will be selected by the judges for a final trial.

For the preliminary tests both tanks submitted will be subjected to a crashing test of the following nature:

Each tank will be mounted in a wooden structure and located behind a concrete body formed to represent an engine. The tank will be released down a wire ropeway approximately 100 feet high, so arranged that the structure will strike the ground at an angle of not less than 45 degrees from the horizontal and will be free to turn over. This will ensure as far as possible the conditions prevailing in a typical aircraft crash. The tank will contain 22 gallons of petrol which will be supplied by the Air Ministry.

In the four tanks supplied for the final tests minor modifications of the original design may be made, provided the judges have previously decided that the modification is one of detail and not fundamental principle. The tanks will be required to undergo a similar crashing test as in the preliminary stages and also a firing test in which they will be subjected to machine gun fire with ammunition capable of penetrating the ordinary type of mild steel fuel tank and leaving small entry and large exit holes when the tank is struck below fuel level, and exploding and igniting the fuel either on contact or after penetration.

A series of bursts of five rounds each will be fired at a range of 50 yards, the tank being examined after each burst. The angle of fire will be at the discretion of the judges.

At any time during the competition the judges may impose such other tests (e. g. to determine the resistance to acceleration, etc.) as they may desire in order to demonstrate the relative merits of competing tanks.

There will be an interval of at least eight weeks between the preliminary and final tests.

In the case of scout aircraft the stress due to acceleration may amount to three or four times that due to gravity.

Bourget Air-Pageant

For this year the idea of a French Air-Pageant has been shelved. It is to be held at Easter, 1922, at Bourget. M. Flandin is the Hon. President of the Organizing Committee, and M. Léon Bathiat, President. Eighty per cent. of the profits goes to the funds for relief of aviators and the balance to a similar fund for sporting journalists.

The "Movies" in an "Aeroplane"

A novel form of show is foreshadowed in the registration of a company, under the title of Holcroft Cinema Aeroplane, Ltd. The *raison d'être* of the company is to provide a cinema entertainment actually given in a large model aeroplane invented by Major Charles Holcroft, which performs certain motions and gives to the public the benefit of cinema entertainment coupled with the sensation of flying, etc. Mr. E. Lewis Waller is a director of the company.



How To Build a Flying Scale Model of the Curtiss 18-T Triplane

Tail Plane Construction

(Continued from last week's issue)

SPARS are made of ⅛" by 1/16" white pine. Correct lengths outline, drawing of the tail planes and marking off the corare cut by laying the material directly on a full-sized rect length and relative positions of the spars. Edging is bent to shape over a candle flame and secured to the frames, or spars, as shown. Cover them with silk or silk paper. If silk is used, varnish with bamboo varnish.

Landing Gear Construction

Cut the landing gear strut material to the streamline section as shown on the drawing. Cut two front and two rear struts to the length and shape shown and then cut the slots in the ends to insert the small veneer pieces. Cut a small veneer piece from 1/16" thick mahogany or white pine. Insert the small veneer piece in the struts and glue them fast and let dry. When they are dry, drill a 1/16" hole for the axle to fit in.

Cut the tail-skid to the shape and size shown. Insert it in the opening made for it underneath in the lower half at the rear of the fuselage and glue fast.

Construction of Motor Stick, Nose Piece and Hanger

Make the nose-piece of white pine ½" thick and cut to the streamline shape. Drill a ⅛" hole for the ball-bearing shaft to pass through and a 5/16" hole for the ball-bearing race to fit into. Cut out the insertions by which the piece is secured to the front end piece of the body and drill a 1/32" hole through the centers. Cut out a 1/16" deep groove on the back side, for the propeller hanger to fit into.

Propeller hanger is cut from a piece of brass 1/16" thick, 4⅝" long and ¼" wide. Drill all holes before bending the piece to shape. Insert the hanger in the 1/16" deep groove in the nose-piece and fasten with ¼" screws.

Cut the motor stick from a piece of ¼" square white pine. Screw the rear motor hook in place and fasten the motor stick to the hanger with ¼" screws.

Propeller Construction

Secure two pieces of the very best straight grained clear *dry* white pine ⅞" in thickness. Cut the pieces to the shape shown. Make a *good* half-and-half lap-joint and glue the two blocks together and clamp tight until thoroughly dry. When dry draw the propeller outline on the blocks and saw out on a bandsaw or jig-saw. Taper the ends as shown in the side view of the propeller drawing. Carve out the blades, leaving a rather thick cross section as shown. Sandpaper nicely and give two or three coats of bamboo varnish.

Assembly of the Parts

First insert the spars of the lower and middle planes in place. Attach the interplane struts and glue them fast. Attach the upper main plane to the struts and glue fast. Wire with No. 34 tinned wire.

Insert the stabilizer plane in place and glue fast. Attach the elevators with No. 34 wire. Insert the fin and glue fast. Attach the rudder to the fin with No. 34 wire.

Insert the landing gear struts in place and glue them fast. Put the axle and wheels on as shown. A 1/16" inside diameter brass tube may be used as a spacer to keep the struts from bending in. Wire with No. 34 tinned steel wire.

Nail the ⅛" square motor stick brace in place and glue. Insert the ball-bearing propeller shaft through the nose piece and hanger and make a neat hook on the shaft. Screw the nose piece to the front end piece of the body and fasten the motor stick to the rear motor stick brace with a strip of rubber as shown. This will permit the motor stick to twist. Screw the propeller on the shaft and line everything up nicely and truly.

If the balance point is found to be not at the correct location new holes may be drilled and main planes set back sufficiently. See that everything is nicely trued up, before flying. Use about ten or twelve strands of 3/16" flat rubber as motive power.

Models Built By Readers of Aerial Age

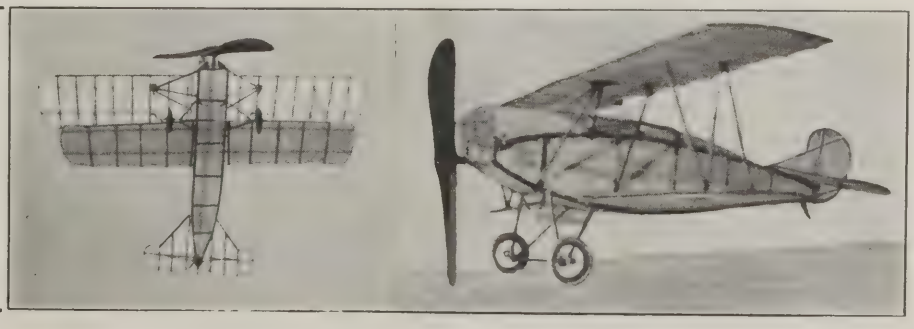
The Fokker model, illustrated in the photograph below, was built from plans published in AERIAL AGE on January 24th. Its builder, Mr. D. A. Marshall, of Toronto, Canada, has recently added this type to a rather extensive collection he now has of well-known types of aeroplanes.

Mr. Marshall is keenly interested in the development of model aeronautics in Toronto and will lend his aid to foster the suggestion of a Toronto club broached in AERIAL AGE recently. Encouragement of the right sort has been given to model builders by Col. Barker, the noted Ace, who gave two prizes a little more than a year ago when he opened up Broadview Boys' Fall Fair. As prizes, aeroplane flights were awarded—a fifteen minute trip for first prize and a ten minute trip, second. Mr. Marshall's skill in model building was rewarded by the first prize trip, which naturally gave him the desire to fly a machine of his own. It is likely that Mr. Marshall will attempt the construction of a motor-cycle engined aeroplane and that AERIAL AGE readers can expect to hear more of his accomplishments.

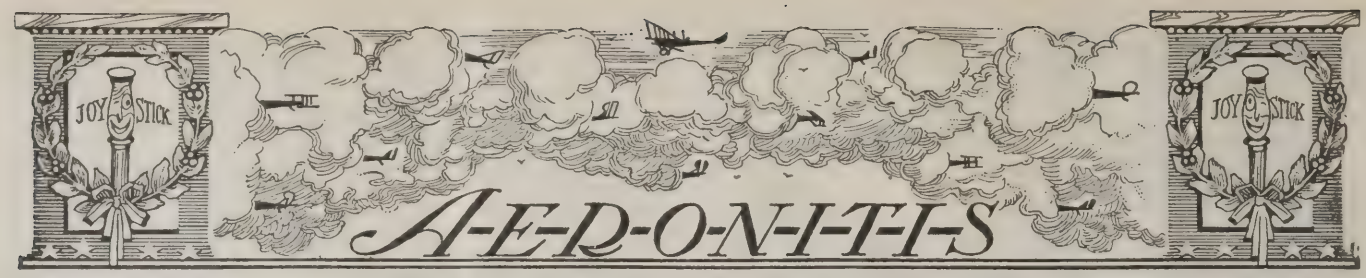
New Names Suggested For Motorcycle Engined Aeroplanes

One of our readers, commenting upon the article published in AERIAL AGE on the subject of an "Aeroplanette" Club, has some ideas on the subject which seem to be an improvement on the first suggested name. Inasmuch as the wing, plane or supporting surface is the outstanding and distinctive feature of an aeroplane, it is suggested that the names "Motorwing" or "Motorplane" would be more appropriate and more convenient for general use.

It may have been noticed by our readers that the word "aeroplane" is used entirely throughout the editorial columns of AERIAL AGE. As some of the newspapers and other publications have adapted the name "airplane" there seems to be an open question as to which name is in the most general use. In justification of our use of the word "aeroplane," let our readers observe for themselves how many times they hear the word spoken *"aeroplane"* and how seldom they hear the word pronounced with the "o" omitted.



The Fokker D-7 Scale Flying Model Built by D. A. Marshall from plans published in Aerial Age



Starting the Day Right

A pretty stenographer had been transferred by the firm to another city. The first morning after the change had been made, she came into her new office, hung her hat and coat on the rack and meandered leisurely to the boss' desk.

"Well," she said, "I suppose you start in the day here the same as we do in Blanktown?"

"Why, yes, I suppose so," replied the boss.

"Well, come on, then, kiss me so I can start working."

—*Whizz Bang.*

How to use a telephone: Take up receiver. Yell "Hello." Yell "Hello" again. Yell "Hello" six times. Then yell only the first syllable of "Hello." Then put the last syllable before the first and yell that. Then hang up.—*Our Navy.*

Chief: "Line up alphabetically, the 'A's' first, then the 'B's; what's your name?"

Boot from North Dakota: "Phillips, sir!"

Chief: "Phillips, wotell you doin' up the head o' the line, get down among the 'F's' where you belong."

How Come?

Found—Lady's lingerie and stockings with auto cushion in pasture on Oak Blvd., two miles south Vernon road near the Morgan farm called "Buenos Aires."—*Whizz Bang.*

A tool chest was the old hen's nest,
I'll bet you cannot match it;
She cackled when she tried to set
Upon a nail and hatchet.

—*Whizz Bang.*

Might Understand

"You don't deny that you were exceeding the speed limit?"

"No, your honor."

"Have you a valid excuse to offer?"

"Not a valid one, I'm afraid," replied the motorist, dreamily, "but you ought to see the girl who asked me to 'step on the gas.' "—*Birmingham Age-Herald.*

Kriss: "That girl doesn't care how much of her leg she shows."

Kross: "Neither do I."—*Judge.*

Silly

He: "Are we alone, dearest?"

She: "No, I think we're together."—*Judge.*



"CURFEW SHALL NOT RING TO-NIGHT!"

The Lure of the Air

This is the reason we love the Air:—
This is the reason our joy is to fly:—
For up on high there are beauties rare
For which the "Earth-bound" in vain shall sigh.

Then come for a flight in the beautiful blue;
In a plane that's built just 'special for two.
High up o'er the clouds we swiftly will climb
A view there, a picture, that's truly sublime.
Below us the cloudbanks like silver and gold,
A sight of rare beauty to our view does unfold.
And up o'er our heads, still quite far away
The Heaven's true blue we with joy shall survey.

Then a Dip and a Dive, A Spin and a Glide,
And now once again near the earth we shall ride,
But ever, deep in our hearts is there,
The call of the CLOUDLAND, THE LURE OF THE AIR.

B. H. Krueger.

Too Much to Hide

Oscar contends
That when a lady
Spends $8 for a pair of hose
She has a right
To display
At least $7.50
Worth o' them.

—*Columbus Dispatch.*

Peter Piper played a pot of poker,
A pretty pot of poker Peter Piper picked.
But a piker with a poker picked on Peter Piper.
And pocketed the poker-pot that Peter Piper picked!

Naval Academy Log.

He Took the Hint

He: "If I should kiss you, would you scream for help?"

She: "I certainly should—if you required any."

Visitor (at remote fishing village): Ah, a library?

Postmistress: Yes, sir, but you're too late. Another man just borrowed it.—*London Opinion.*

Sandwich Isles

Mary had a little lamb
Between two hunks of bread,
The S. P. C. A. did not complain
Because the lamb was dead.

—*Vaudeville News.*

Hard Luck

Knick: "What made you delay your trip to the country?"

Knack: "After the trunks were all strapped I found I was, too."—*Judge.*

Curtain Time

Mary wore two silken sox,
Rolled down below her knee;
But Mary once had chicken pox;
Which spoiled the scenery.

—*Carnegie Puppet.*

Footpad: "Hey, Bo! Yer money or yer life!"

Wayfarer: "How dare you address me in such a vulgar manner! Have we been introduced?"

—*Le Journal Amusant (Paris).*

A Sure Shot

Two jags were returning home after a big spree lasting nearly all night.

"Don't your wife miss you on these occasions?" asked one.

"Not often," replied the other, "she throws pretty straight."

—*Texas Scalper.*

"What have you to offer my daughter in case I give my consent?"

"Well, I'm studying law, so I shall be able to offer her free legal advice."—*Boston Beanpot.*

AIR LAIRD PLANES WICHITA, KANSAS

The Laird Swallow

"America's First Commercial Airplane"

NOW $4,500 F. O. B. WICHITA, KAN.

INCREASED production enables us to announce this reduction, effective immediately. At this price the Laird Swallow will be the most wonderful buy in America today. Brand new in every detail—built in our own factory, powered with the OX5 motor, carrying three passengers with full load of fuel and baggage—magnificent in performance—remarkably low upkeep and operation costs.

Our new sales plan will be most interesting to every person interested in aviation. Write for details and booklet.

E. M. LAIRD COMPANY

Manufacturers
WICHITA, KANSAS
General Sales Offices
2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.,
2216 So. Michigan Ave., Chicago, Ill.

Please send me details of your new sales plan and copy of booklet.

Name .....

Address .....

.....

AA

PRICE LIST

Lincoln Standard Airplanes

Effective September 5th, 1921

	Old Price	New Price
Tourabout	$6500.00	$3985.00
Speedster	6500.00	3985.00
Raceabout	7500.00	3985.00
Cruiser	9000.00	5485.00

F. O. B.
Lincoln, Nebraska

Our plant is in steady production and it is our aim to keep at least 50 planes in stock at all times for quick delivery.

We carry an enormous stock of all kinds of repairs ready for instant delivery on receipt of a wire.

The Lincoln Standard ships are equipped with Hispano-Suiza motors of 150 and 220 H. P. type.

NEBRASKA AIRCRAFT CORPORATION

LINCOLN, NEBRASKA

CANUCK — OX5

Special Offer:

COMPLETE SET (4 Panels) CANUCK WINGS, brand new, with INTERPLANE STRUTS & AILERONS	$550.00
NEW RUDDERS	35.00
NEW ELEVATORS	25.00

AMERICAN CURTISS TYPE LANDING GEAR

Complete, with wheels, tires and all fittings. New, in perfect condition. **$130.00**

NEW RADIATORS, our price..... **30.00**

NEW GASOLINE TANKS..... **27.50**

ENGINE PARTS, SUPPLIES, AND ALL OTHER MATERIALS

at proportionate prices. New, inspected goods and prompt shipment guaranteed.

WRITE FOR OUR SPECIAL COMBINATION OFFERS!

AVRO & CANUCK (2 & 3 Seaters) } AT EXCEPTIONALLY
LARGE AIR-LINERS (3 & 4 Seaters) } FAVORABLE PRICES

JAMES LEVY AIRCRAFT COMPANY

2029 Indiana Ave. **Chicago, Ill.**

SUPPLIES
CANUCK "JN" "OX5"
IMMEDIATE SERVICE

Our large stock is positively the most complete in the States. When you order it from us you get it. No time lost from partial shipment. All materials guaranteed new and unused. Write for special season price list.

Used and new planes	$1500.00 to $4750.00	OX5 crankshaft.....	$25.00
Wings, lower.....	125.00	OX5 camshaft.....	15.00
Wings, upper.....	135.00	OX5 Lynite piston, with rings and wrist pin	6.00
Complete landing gears with wheels and tires	140.00	Piston rings.....	.20
Set of 6, landing gear struts, Canuck or JN	15.00	Tungsten steel valves.	2.00
		Dixie magnetos.....	50.00

All other supplies at proportionate figures, all new.

AMERICAN AIRCRAFT
Incorporated

Aerodrome, Logan Field, Md. — Baltimore, Md. Station F, Box 104 — Stores, Dundalk, Md.

ECONOMY

IS NOT JUST A QUESTION OF LOW FIRST COST
BUT ALSO
LONG SERVICE and RELIABILITY

USE

TITANINE

TRADE MARK

DOPES and COVERING MATERIALS
MADE BY

TITANINE Inc.
Morris & Elmwood Aves. Union, Union County, N. J.

L. P. WITHERUP
Mechanical Designing Engineer
Specialist on
Lubrication and Bearing Problems.
I Make Your Own Bearings or Bushings Work Without Heating.

DESIGNING
DEVELOPMENT
DETAILS
DELIVERY
} of {
Internal Combustion Engines of any type, class or service. Airplanes to Farm Engines.
Invention Devices, Manufacturing, Air Compression, Pattern and Machine Work.

If you have a two-cycle engine giving you trouble or will not develop its full power, write me particulars and I will straighten it out.

LOCK BOX 1472, CINCINNATI, OHIO

CANUCK
AND
OX5 ENGINE SPARE PARTS
IMMEDIATE DELIVERY

C. A. L. PROPS $15 PARAGON PROPS $30
ROME-TURNEY RADIATORS $20

Also Complete Assortment of Standard Utility Parts
Get Our Prices Before Ordering

AIRCRAFT MATERIALS & EQUIPT. CORP.
1409 SEDGWICK AVE. NEW YORK CITY

WING COVERING
Doping, Pigmenting, Enameling, Varnishing accurately, quickly and economically done
LINEN, LINEN TAPE, LINEN COVERS, DOPE

Grade A Linen—90c per yard
Grade A Cotton—50c per yard
Scalloped Cotton Tape—6c per yard

AVIATION MOTORS
Overhauled and Repaired by French Engineers
Rotary Engines a Specialty

G. VOISIN, Expert
20 years of practical experience
Tel. 139 W. Hasb. Hgts. 236 Franklin Ave., Hasbrouck Heights, N. J.
Factory: 70-72 Rome St., Newark, N. J. Tel. Market 9170.

FLYING SCHOOL
Our Graduates Are Satisfied
YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet.

PHILADELPHIA AERO-SERVICE CORPORATION
636 Real Estate Trust Bldg. Philadelphia

FOR SALE—Complete hull for Aeromarine Navy Cruiser in excellent condition and Liberty Motor with thirty hours' time, $2,000.00. Wings, tail surfaces, etc., can be bought for this machine from the Navy for about $1,500.00. This is an opportunity to acquire one of these money-making boats at very reasonable price. Also brand new Curtiss "F" Boat, natural wood hull and aluminum painted wings without motor $1,700.00 with rebuilt Curtiss OXX-6, 110 h.p. motor $2,000.00. Above equipment offered subject to prior sale, F.O.B. Annapolis, Md.

EASTER AIRLINES, Inc., Hanover Street Bridge, Baltimore, Md.

WE carry a complete line of spare parts for Standard J-1 Planes and Hispano-Suiza engines, together with an enormous stock of material and repairs common to all makes of airplanes. Let us know your requirements.

NEBRASKA AIRCRAFT CORPORATION
Lincoln, Nebraska

SEVEN carloads new JN parts at bargain prices. OX5 and OXX motor parts. OXX and Benz six cyl. 110 H.P. and Mercedes six cyl. 160 H.P. motors installed in your plane rebuilt for three passengers at surprising low cost.

We are located permanently and offer our fourteen years' continuous aviation experience. Try and be convinced. Send today for price list.

PARKER AIRCRAFT CO.
Perry, Iowa

Say—Men—How Do These Prices Sound?

Canuck Wings	Uppers $120.00 Lowers 115.00	Tachometers, Altimeters or Compasses.....	15.00
Ailerons	15.00	New D-5000 Mahogany Cop. Tipt. Props.....	50.00
Rudders or Elevators....	12.00	Special Low Prices on "D" Parts Are Even Slightly Lower Than Above	
Axles, Tires, Struts, New Pistons, 4 New Valves, Each	5.00	Re-built OX-5 Motors...	$300.00
Used A1 Cylinders (nearly new)	10.00	New OXX-2 Left Hand..	650.00
Radiators (used) but A1	17.50	Used and New Planes (Ready to fly)	$1250 to 2500.00

DE LUXE AIR SERVICE, Inc., Asbury Park, N. J.
(Wings now in crates one block from R. R. Station)
50% must accompany all orders.

AVIATION
FLYING AND GROUND SCHOOL

COURSES TAKEN SEPARATELY OR COMBINED

We have the very best of flying instructors. Our ground instructors will teach you motors from A-Z and show you how to build an airplane from the ground up.

We specialize on MOTOR MECHANICS and RIGGERS and can turn you out qualified to handle such position paying from $200 to $300 monthly.

Write for descriptive literature.

THE LOWELL AIRCRAFT CO., Inc.
Oberlin, Ohio

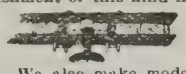
CURTISS SHIPS FOR SALE
$500.00 AND UP

CURTISS EASTERN AIRPLANE CORP.
130 S. 15th STREET PHILADELPHIA, PA.

Wittemann-Lewis Aircraft Company, Inc.
Airplanes **Seaplanes**
Developers of Special Aircraft
BUILDERS SINCE 1906
TETERBORO, HASBROUCK HEIGHTS, NEW JERSEY

Students of Aviation, Model Builders and Experimenters

The Wading River Model Airplane & Supply Co., as the oldest establishment of this kind in the U. S., is able to supply you with the best material at the most reasonable prices.



Scale Drawings and Blueprints of some of the latest types always on hand.

We also make models to your own plans at reasonable prices.
Send $.05 for Illustrated Catalog.

WADING RIVER MFG. CO., 672 Broadway, Brooklyn, N. Y.

Imported Commercial Aerial Cameras

Latest model brand new 7" x 9" GAUMONT CAMERA, 20" f/6.3 Krauss Lens, 12 plate automatic magazine suitable for mapping and obliques.....$500.00
Extra 12 plate automatic magazines..... 40.00
5" x 7" GERMAN ICA CAMERA, 12" f/4.5 Voigtlander Heliar Lens including four all aluminum plate magazines 400.00

FAIRCHILD AERIAL CAMERA CORPORATION
136 West 52nd Street New York City

Advertising in this department 10c a word $2.00 minimum

Classified Advertising

Forms close for this department on Monday preceding date of issue

PATENTS Ex-Pilot U. S. Air Service
ALLEN E. PECK
Patent Attorney
Pacific Bldg., Washington, D. C.

FOR SALE—H-S-2 six passenger Aeroplane with new Liberty Motor, Self Starter, and in first-class condition. Price right. Ideal for passenger carrying. Can be seen at or write to Riverside Park, Agawam, Mass. J. H. Allen.

FOR SALE—Enormous stock OX-5 Motor parts. Best prices. Try us for quick service. The Lowell Aircraft Co., Oberlin, Ohio.

ONE CURTISS JN4D AIRPLANE in excellent condition which has been used as a sports plane by private party. Equipped with all instruments including speed indicator, compass, etc. Price $1000.00. Address: G. S. Ireland, 130 S. 15th St., Philadelphia, Penna.

PILOT—Experienced Army and Commercial Pilot desires position. Will go anywhere, good mechanic. L. J. Mason, 2233 Calumet, Chicago, Illinois.

WANTED—We buy and rebuild airplane crashes. Try us for prompt, accurate and satisfactory work. The Lowell Aircraft Co., Oberlin, Ohio.

WANTED—Experienced Airplane Draftsmen, capable of design. State age, education, experience and salary expected. G. Elias & Bro., Inc., Buffalo, N. Y.

NEW STANDARD J-1 with new OX5 motor ready for immediate delivery at Houston, Texas, $1500.00. E. J. Bond, 609 Main St., Houston, Tex.

FOR SALE—JENNIE PARTS: Uncovered surfaces of a complete JN-4D including fuselage; also tail skids and extras. What parts do you want? New York Fliers, Inc., Box 637, Rochester, N. Y.

SEVERAL AEROPLANE CAMERAS for sale with Bausch & Lomb 8½-inch (I. C. Tessa F4.5 in aerial mount), including magazine holders carrying a total of 36 plates. Cameras brand new, same as used by U. S. Air Service during war. Price F. O. B. New York $350.00. Address Box 610, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE OR TRADE—Curtiss Jenny in good condition and ready to fly, $1600. $1000.00 cash, terms on balance. H. W. Tennant, Box 895, Sioux Falls, South Dakota.

PILOT wishes flying position. Anywhere! Address Box 619, Aerial Age, 280 Madison Ave., New York City.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

CANUCK, without motor, newly linen covered throughout, not flown since; a Beauty; Bargain; $1200. Harry Flanders, 934 E. 76, Cleveland, Ohio.

K-6 ORIOLE, OX5 STANDARD AND JN4D, all in first class condition, for sale at sacrifice. 613 North Marsalis Ave., Dallas, Tex.

C. A. L. PROPELLERS $20, very efficient; others at $32; copper tipped $42; Canuck and OX5 parts at cut rates. No catalog—specify your wants. Chas. H. Paterson, 6504 So. State St., Chicago, Ill.

CANUCK just refinished Khaki color; very pretty; flies nicely; motor turns up well; big snap; $1275. Frank Campbell, 712 West Superior, Cleveland, Ohio.

FOR QUICK SALE—New Ace power plant, motor, propeller, motor mounting, etc. 40 H.P., 125 lbs., price $175. Also OX5 good condition, just overhauled $200, and Curtiss V2 $200. Harry B. Crewdson, White Bear, Minn.

DH-6—COMPLETE $800—Excellent condition. At present doing exhibition work. Also extra parts, OX5 Motor, Canuck Wings, etc. Harrisburg Aeroplane Co., Harrisburg, Pa.

RELIABLE COMMERCIAL PILOT with clean record desires position. Will go anywhere. H. H. Emrick, General Delivery, Dayton, Ohio.

EX-ARMY PILOT wants job as commercial flier. Will start on very small salary. Will go anywhere. V. M. Jones, 7612 1st Ave., Birmingham, Ala.

SPECIAL VALUES. New Curtiss Canuck, sacrifice for cash. New fabric throughout. Just completed. With new OX5 motor. Ready for test flight September 1st. Performance guaranteed. For quick action, $1,595.00. Rebuilt Canuck, overhauled motor. Ready for test flight. Will trade for good car or sell for $1,250.00 cash. One complete set new Canuck wings, with ailerons. Just covered with best grade fabric, including fittings. Ready for use, $400.00. A quantity of uncovered Canuck and JN4D wings, ailerons, elevators, stabilizers, etc., at correspondingly low prices—for September only. Haug's Independent Airplane Co., 1506 F. & M. Building, Ft. Worth, Texas.

CANUCK in fine condition—set up ready to fly. Spare radiator and almost complete extra motor, $1250. C. H. England, 1404 McGee, Kansas City, Mo.

ANZANI forty-water-cooled $200. Acetate dope $2.25 gallon. Nitrate $2.80 gallon. Genuine aeroplane linen $.75 a yard. Tape 8c a yard. Everything aeronautical. Specify requirements. Ostergaard Aircraft Works, 4269 North Narragansett, Chicago.

FOR SALE—Model A 150 Horsepower Hispano Suiza motor, twenty-one hours—tools, complete set spares, including blocks, pistons, etc. Address Box 613, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—Brand new 3 place Avro. 110 LeRhone motor, $3250. Two thousand cash. Balance terms. Oriole with K6 motor, $3000. JN4 with OX5 motor $1250. Last two completely overhauled and perfect. Muskogee Airplane Co., Muskogee, Okla.

FOR SALE—"F" Boat. Beautifully finished, natural wood hull, aluminum wings. Never been used. $2500. Also used "F" boat, very good condition $1200. Address P. E. Easter, 318 Woodlawn Road, Baltimore, Md.

NEW LAWRENCE MOTOR, double cylinder, air-cooled, 28-40 H.P., weight 130 lbs. With ignition system, Zenith carburetor and new ash metal tipped propeller complete $175. Send certified check and avoid disappointment. Heber H. Hunt, Aeronautical Engineer, P. O. Box 1643, Washington, D. C.

FOR SALE—New OX5 motors, $475. Rebuilt OX5 motors, practically good as new, $300. The Lowell Aircraft Co., Oberlin, Ohio.

FOR SALE—J.N.4-D American Curtiss with OXX 100 H. P. motor. Price $2000.00. Wire F. K. Smith, 14 Hodges Ave., Taunton, Mass.

AIRPLANE PARTS AND ACCESSORIES

Johnson Airplane and Supply Company
DAYTON, OHIO

New and used Curtiss Motors; also used Beardmore and Hispano Motors in excellent condition, all at bottom prices.

New 26 x 4 wheels with streamline	$10.00
New 26 x 4 Goodyear casings	10.00
New Goodyear tubes	2.50
New 30 x 5 wheels	3.00
New 30 x 5 casings	10.00
New 26 x 4 Ackerman Spring wheels	20.00
New casing and tube for same	15.00
Brass olive joint for gas line (Prevents gasoline from touching nose)	.10
Oil gauges, 50 to 60 lbs	3.00
Air gauges, 10#	2.50
Water temperature gauges with radiator connection	6.00
Champion spark plugs	.75
Dixie 2-magneto switches	5.00
Hand air pumps	5.00
Hand gasoline pumps	10.00
Gas strainer and copper gas line	2.50
3-way gas valves for gasoline or air line	5.00
No. 18 copper safety wire, 100 foot spool	1.00
Standard dual controls	10.00
Standard vertical radiators	20.00
Standard leather cushions	1.50
Standard axles	2.50
Standard longerons	5.00
Linen covers for all surfaces	

Titanine clear dope and pigmented dope in all colors. We carry a varying stock of spares for all makes of planes and motors.
We have Standard, Dee, and Canuck planes ready to fly. We also rebuild these planes to carry any motor desired.

Write for our Price List

New Aeroplane Supply Sale

Acetate Dope Guaranteed 55 Gal. Drum and 50 Gal. Bbls. $1.00 per Gal. No charge for containers. 5 Gal. lots $2.25 per Gal.

Spar Varnish, 5 Gal. cans, $2.25 per Gal.

Green Brown Wing Enamel, 5 Gal. cans, $1.50 per Gal.

TYCOS ALTIMETERS, register 20,000 feet radius, $15.00 each.

New Leather Aviation Helmets, $5.00 each, cost $18.00.

½" Brass Gasoline Stop Valves, $6.00 per Doz.

AC Spark Plugs Metrics $3.00 per Doz. $20.00 per hundred. $180.00 per M.

4" Barrel Turnbuckles $3.00 per Doz. $15.00 per hundred.

Wicker Pilot Seats, $4.00 each, $36.00 per Doz.

Tufted Fabricoid covered cushions for above $1.25 each.

Size No. 2½ Tinned Tacks, 15c per lb.

MAX TOPPER & ROSENTHAL
11th Ave. & P.R.R. Tracks — Columbus, Ohio



(*Continued from page* 11)

or may be higher. The limits of the ignition velocity utilized in the engine are about 1.5 to 2.5 m/sec. (5 to 8 ft. per sec.) and therefore at these ignition velocities, the thermal value of the mixture would be highest with gasoline, and lowest with hydrogen. This also explains why the highest mean effective pressure ever attained, between 9 and 10 kg/cm², (128 to 142 lbs. per sq. in.) was to be found in the gasoline engine.

This opens up another profitable field of study—that of the ignition velocities of gasoline and all other economically utilizable fuels over a wide range of temperatures from those encountered at the beginning of compression to the temperatures at the end of compression. Nusselt believes the effect of initial temperature is very great.

The lecturer finally considered the question of weight of the aviation engine which must always be more important than the fuel problem.

$$\frac{G}{N} = \left(\frac{P_{max}}{P_m} \cdot \frac{d}{\frac{s}{V_m}} \right) + A \qquad (4)$$

Equation 4 expresses the engine weight per horsepower when the engine is considered as an intergration of mechanical energy from several units, and as a transmitter of energy from the several combustion chambers through the piston, connecting rod linkages to the shaft, and thence to the propeller, on which the forces p act at different points. The power N of the engine depends upon (1) the mean value P_m of the forces applied to the pistons and (2) the relative velocity V_m between the moving and stationary parts of the energy conduit. The product $P_m \cdot V_m = N$ remains constant (apart from losses due to friction) in all the cross sections of the energy conduit. The structural material used, and consequently, the weight G is, on the other hand, essentially determined in every section of the energy conduit by (1) the maximum forces P_{max}, (2) the admitted strain s and (3) the specific gravity d of the working material. A is a supplement for the fuel conduits, the valve gear, and other accessories.

The principal determinations for the value G/N are the following: (1) the absolute length (1) of the energy conduit; (2) the permissible value s of the structural material; (3) the permissible maximum values for V_m, and (4) the value $\frac{P_{max}}{P_m}$

The value of $\frac{P_{max}}{P_m}$ for the piston, valve gear and the cylinder is equal to the value of $\frac{P_{max}}{P_m}$ for the entire engine, and in the case of the cylinder and piston, the ratio of the maximum pressure P_{max} to the mean pressure due to inertia of the masses must be taken into account. The following deduction may be drawn from equation (4). Should P_m be less than normal, in consequence of a low cylinder charge or the heating of the intake mixture to a high temperature, P_{max} will be lower in proportion, so that the ratio $\frac{P_{max}}{P_m}$ remains unchanged. The engine with reduced volumetric efficiency will not of necessity be heavier as it can be built considerably lighter because the quotient $\frac{P_{max}}{P_m}$ alone is decisive. When the compression ratio is low, this quotient is generally lower, so that air-cooled rotary engines turn out very well with regard to their H.P. load, in spite of their unfavorable volumetric efficiency and their low compression ratio. (This is certainly also due to the short length of the energy conduit "1" and to the lightness of the accessories A.). This relation shows that aviation engines can be perfectly well built with low weights per H.P. when using prepared fuel mixtures, in spite of the fact that they take in hot air or have extremely hot walls in order to obtain adequate vaporization, or they work with low pressures during the suction stroke in order to obtain adequate atomization.

The combustion type of engine therefore should not be chosen for aviation, or light automobile engine designed for the use of fuels of high boiling point. The latter will always be more difficult to construct on account of its high value of $\frac{P_{max}}{P_m}$ (without taking the heavy accessories into considera-

The Spark Plug That Cleans Itself

B-G

Contractors to the U. S. Army Air Service
and the U. S. Navy

THE B. G. CORPORATION
33 Gold Street New York City, U. S. A.

Baker's
A-A
Castor Oil



Specially Refined
for the Lubrication of
AERONAUTICAL MOTORS

BAKER CASTOR OIL COMPANY
Founded 1857
The Oldest and Largest Manufacturers of Castor Oil in the United States
120 BROADWAY NEW YORK

SPECIAL OFFER (to Sept. 15th, 1921)
Limited Quantity of
New Wheels with Casing and Tube
$12.00 complete. F.O.B. Buffalo
CANUCK
JN and OX5
SPARES and SUPPLIES
ONE USED "CANUCK" $1200.00 U.S. Funds
F.O.B. Leaside
Write us Direct for Quotations
ERICSON AIRCRAFT LTD.
120 King Street E. Toronto, Canada

Aeroplane Cloth
Pinked Tape—All Widths
Tested and Guaranteed
to Grade A Specification 16,004.
Immediate Delivery.
W. Harris Thurston & Co., Inc.
116 Franklin St., New York
Contractors to the U. S. ARMY and NAVY
Tel. Franklin 1234

tion). The aviation engine should rather be selected from the ignition engine class with the best possible atomization and comparatively low compression ratio. With this end in view, a systematic investigation should be made of all the important characteristics of fuels, so that the heavy-oil aviation ignition engine may attain the unusual record values which now distinguish the best light-oil ignition engines from all other combustion engines, namely:

Gasoline consumption—180 to 190 grams, 0.40—0.42 lbs. per H.P. hr.

Mean useful pressure—9 to 10 kg/cm², 128 to 142 lbs per sq. in.

Load per H.P.—Only 0.8 to 1.5 kg., 1.8 to 3.3 lbs. per H.P.

Note I

The surface tension of the fuel is probably of much greater importance than its viscosity in affecting atomization.

Note II

This is not true should the temperature of the gasoline decrease as the air temperature decreases with increasing altitude. It is probably true, should the temperature of the gasoline in tanks and fuel lines remain the same in flight as on the ground.

Note III

This assumes no heating of the carburetor or manifold.

Note IV

Cooling of the entire weight of air necessary for one pound of hexane 30°C would supply about 193 B.t.u.; whereas, only about 143 B.t.u. are required.

Note V

It is very doubtful that hexane is the principal component of any of the present commercial gasolines, evcept possibly, aviation gasolines.

Note VI

If the values given are for the chemical combining mixture ratio of 15.2 to 1, the manifold pressure assumed is 731 mm. mercury. Should the manifold pressure be assumed as 760 mm. of mercury, the mixture ratio will be 15.7 to 1.

Note VII

The mixture ratios for the saturation values of the fuels given in Figure 4, as computed from published data, are as given below:

	Mixture Ratio	*Manifold Pressure mm. of Mercury*
Naphthaline $C_{10}H_8$	12.5	760
	12.9*	785
Decane $C_{10}H_{22}$	15.7	760
	15.0*	738
Ethyl Alcohol C_2H_5OH.....	8.8	760
	9.0*	774
Benzol C_6H_6	15.0	760
	13.2*	669
Hexane C_6H_{14}	15.7	760
	15.2*	730

*Chemical combining ratios.

Note VIII

Were all temperatures mentioned higher than the saturation temperature of the fuel at the pressures existing, *no* condensation or separation could take place.

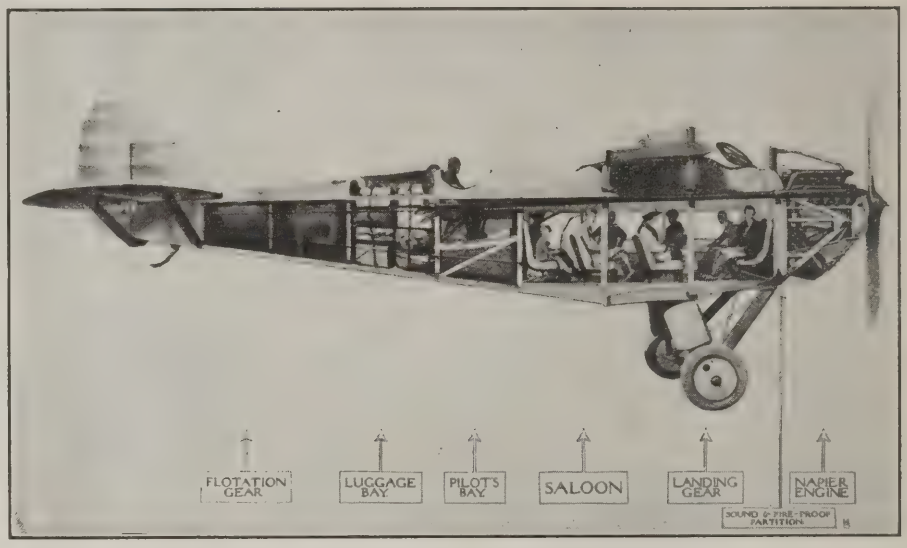
Note IX

This is not altogether true, as the engine may be idle at times which precede demands for reliable engine operation, such as when coming out of a long dive and rising from the ground after an unsuccessful attempt to land.

Note X

When H is in kilogram calories per cubic meter and P_m in kilograms per cm² the constant of proportionality is $\frac{427}{10{,}000}$ when H is in B.t.u. per cubic inch and P_m in pounds per square inch the constant of proportionality is, 778 x 12.

THE DH18



The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

AMERADA ENGINEERING CORP.

505 FIFTH AVENUE
NEW YORK CITY

JUST WHAT YOU WANT

Canuck, refinished, flies well, looks swell.....$1375
Canuck, just all linen covered, less motor..... 1250
Curtiss F Boat with OXX Motor, slightly used.. 2100
New OX5 Motors, complete in original boxes.. 525
Brand new wings for either Canuck, JN4D or J-1 Standard—instant shipment, each..... 150

PROPELLERS—For all type motors, specially low prices: For OX5:—Canadian aircraft, only **$20,** and very satisfactory; Buffalo Mahogany Metal Tipped, **$51;** Flottorp or Hartzell D5000, **$60;** for Hispano 150 H.P., **$75;** for Hall-Scott A7A, **$35;** for OXX6, **$65;** for Curtiss V2 and Salmson 140 H.P., **$65.**

New 26 x 4 Casings, **$9;** slightly used ones, **$5.50,** and they are splendid; moderately used ones, **$3;** very satisfactory; new 26 x 4 inner tubes, **$1.50.**

Nitrate Dope:—**$1.75** per gal. in barrels; **$11.50** for 5 gal., including dandy can; **$2.75** per 1 gal.; Acetate Dope:—**$2** per gal. in 50-gal. drum lots.

Splendid grade linen, **90c per yd.;** A grade mercerized cotton, **55c** yd.; cotton tape, **6c yd.;** NAK Resistal Non-shatterable Goggle, list **$12,** my price **$8;** Tan Chrome Leather Helmet, summer weight, **$6;** heavier, **$7.** (What size?); Champion Spark Plugs, **75c;** Tachometer heads, **$18.50;** Altimeters, dandies, **$38.50;** Propeller Hub Assembly, slightly used, **$25;** OX5 Cylinder Assembly, **$35;** OX5 Cylinder and Jacket, **$26.50;** Berling or Dixie Magneto, list **$125;** my price **$65;** Canuck and JN4D upper wing cover, linen, **$25;** cotton, **$17;** Canuck lower, linen, **$17;** cotton, **$16.**

New and Used Curtiss, Canuck and J-1 Standard Aeroplanes, Motors and Flying Boats.

Splendid stock of Parts for JN4D, Canuck, J-1 Standard, OX5 Motor.

Largest Variety—reasonable prices—promptest shipments

FLOYD J. LOGAN

Bell Phone Ontario 949
712 West Superior Cleveland, Ohio

When Others Are Promising I'm Making Deliveries
Step lively—don't let someone else get your place



LEARN TO FLY

in Chicago with

THE RALPH C. DIGGINS CO.

YOU start flying the day you arrive. Competent Instructors. Newest Types of Planes. Gosport System of Instruction. Thorough Ground Course, including instruction in motors, plane-assembly, wireless, navigation, cross-country flying, field management. Living quarters right here on the field.

PILOTS Receive $5,000 Per Year and Up

ENROLL NOW!

Write for literature and enrollment offer.

THE RALPH C. DIGGINS CO.

Dept. 203 **140 N. Dearborn Street**
CHICAGO, ILL.

5,105
A

AERIAL AGE WEEKLY

L. 14, No. 2 SEPTEMBER 19, 1921 10 CENTS A COPY

UNIVERSITY OF ILLINOIS LIBRARY
SEP 19 1921



Airscape of the Business Section of Salt Lake City, Showing State Capitol in the Distance. Photo by Wilson

Senator Wadsworth Introduces Bill to Regulate Flying and Develop American Aviation

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
criptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

Frank F. Fowle, Editor-in-Chief, assisted by over sixty leading specialists. 25 thumb-indexed sections. 2000 pages. 4 by 7. Flexible. Illustrated. Postpaid $7.40 net.

The "Standard" is the most widely-used electrical book in the world. It is quoted everywhere as the final authority on electrical engineering. It has been endorsed by the leading electrical journals here and abroad. It is an encyclopedia of electrical engineering. Its twenty-five thoroughly indexed sections cover every phase of the subject. The book is the work of more than sixty of the world's foremost electrical engineers. It has been called a triumph of engineering cooperation because of its completeness, its reliability, and its get-at-ableness. [McGraw.]

The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

All orders must be accompanied by check—no books sent on approval

Address: Book Department

AERIAL AGE WEEKLY **280 Madison Avenue, New York**

September 19, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 2

TABLE OF CONTENTS

The Need for More Engineering in Aeroplane Design 27
Weight Estimation in Aeroplane Design 27
The News of the Week 28
The Aircraft Trade Review 30
Cox-Klemin Rebuilds Standard with Mercedes Motor 31
Senator Wadsworth Introduces Bill to Regulate Flying and Develop American Aviation 31
The Employment of Airships for the Transport of Passengers 33
The Nieuport-Delage Airplane, Type 30-T 37
Foreign Technical Digest 38
Naval and Military Aeronautics 39
Foreign News 40
Elementary Aeronautics and Model Notes 41
Aeronitis 42

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

AIR LAIRD PLANES WICHITA KANSAS

The Laird Swallow
"America's First Commercial Airplane"

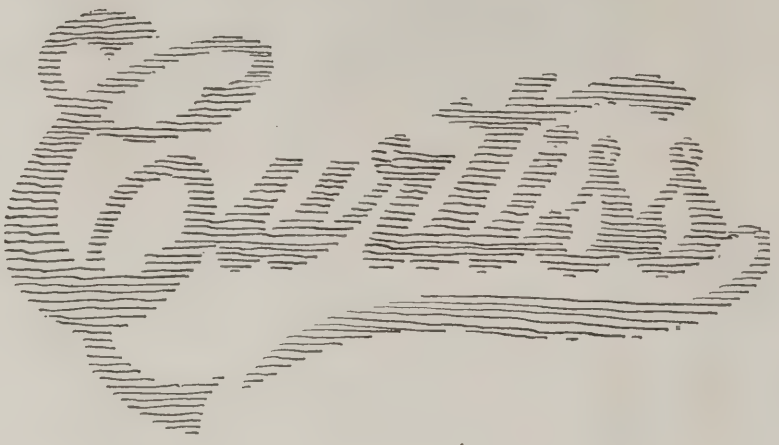
NOW $4,500 F. O. B. WICHITA, KAN.

INCREASED production enables us to announce this reduction, effective immediately. At this price the Laird Swallow will be the most wonderful buy in America today. Brand new in every detail—built in our own factory, powered with the OX5 motor, carrying three passengers with full load of fuel and baggage—magnificent in performance—remarkably low upkeep and operation costs.

Our new sales plan will be most interesting to every person interested in aviation. Write for details and booklet.

E. M. LAIRD COMPANY
Manufacturers
WICHITA, KANSAS
General Sales Offices
2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.,
2216 So. Michigan Ave., Chicago, Ill.
Please send me details of your new sales plan and copy of booklet.
Name .....
Address .....
.....
AA



A Further Reduction

APPROXIMATING 25%

in the price lists of parts

for

Orioles
O X Standards

Jennies
C 6 Standards

is announced

EFFECTIVE SEPTEMBER FIRST

Write for revised price lists.

Motor price lists are not affected in this reduction.

CURTISS
AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLOUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., September 19, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, SEPTEMBER 19, 1921 NO. 2

The Need for More Engineering in Aeroplane Design

NEARLY everyone today will admit the desirability of more engineering and better engineering in aeroplane design. But in commercial work the objection is raised that the expense is too great to be justified. From the viewpoint of immediate returns this contention is sometimes correct, though by no means always. Leaving out of consideration for the moment the problem of direct financial return, how should this question be answered, "Where human lives are concerned is it ever justifiable to skimp on the engineering, or to employ any but the very finest talent that can be had?" If the reader believes that this is not a live issue let him refresh his mind with the terrible disaster to the ZR-2. This was primarily caused by a structural failure, the buckling of one of the main longitudinal girders. Though the responsibility cannot be definitely placed, this failure was probably due to faulty engineering. Forty-three lives and $2,000,000 snuffed out in the space of five seconds—rather a high price to pay for failure to secure the best engineering ability. If this structural defect had been the only bit of poor engineering on the ship, most of the crew would have been able to escape in parachutes, even though the structure did collapse. Unfortunately, owing to a poorly designed fuel system or power plant installation, either the hydrogen or the gasoline exploded with terrific force. It appears that the British during the war lost six or seven airships through fire originating, not from external attack, but within the ship. On the other hand, the Germans had but one airship destroyed in this manner on account of a difficulty that was remedied at once. Would a commercial concern buy an airship from the English company, the builder of the ZR-2, or from a German firm with a clear record? This is a concrete illustration of whether the best engineering pays.

Recently the aviation world received another shock in the collapse of the Jacuzzi monoplane in California. Does any one suppose that if a really competent engineer had designed the wing structure it would have failed? It's rather costly to kill four men and destroy an entire aeroplane to save the expense of a consulting engineer who knows his business.

The certain "Bullet" would not have proved a death trap for several fine fellows had its wings been properly designed. Neither would some of our air mail pilots have been burned to death in JL-6's had the designer of this otherwise admirable aeroplane been a specialist in fuel systems, and understood the precautions for reducing fire hazard. Does it pay to have the services of the highest grade technical men in the country?

Most aeroplane accidents caused by defects in design go to prove the contention that very few men are capable of carrying the entire responsibility of the design of so complicated a machine as an aeroplane. They must have the direct services of various specialists who devote all their time to intensive study of problems in their own field, which may be fuel systems, power plant installation, stress analysis, aerodynamics or production and maintenance. Or they must be thoroughly conversant with the writings and reports of these men. The outstanding point is that if air transport is to become safe, reliable and cheap there must be specialists, highly trained engineers, each solving his own problems and difficulties. If those who advocate the abolition of such institutions as McCook Field, the sole centers of the research and development work which alone will make possible commercial aviation, realized the true facts in the situation they would soon reconsider their stand unless actuated by entirely selfish and short-sighted motives.

Sound engineering from the start is better security than any insurance policy that can be written. In the long run it is far less expensive in direct cost than insurance, especially if a number of aeroplanes of the same type are operated. But aside from this, no amount of money can replace lost lives, and the responsibility for their loss lies at the door of the men who say, "Commercial aviation cannot afford to spend more than the minimum for engineering." B. C. B.

Weight Estimations in Aeroplane Design

UNTIL within the last two years the general tendency among designers was to underestimate weights. This was partly due to lack of data. The designer, having to depend to a large extent upon his judgment, was apt to be as hopeful as possible in guessing at his weights in order to make a good showing in predicted performance. This easy and comfortable self-deception received a few rude shocks when the aeroplanes with full load were weighed, and not found wanting—by several hundred pounds. As a result they were practically failures on account of high wing and power loadings. There were also other factors, however, responsible for underestimated weights. Many designers who were engineers enough to make an entirely honest estimate, and who did come reasonably close to the truth so far as the main structural parts were concerned, because of lack of experience failed to account for the many details on an aeroplane which, though small taken separately, in the aggregate amount to a large percentage of the total weight. Still another cause, generally beyond the designer's control, contributed its share to an underestimate of the final weight. This was the increase in load (misnamed useful) which the

unfortunate ship was compelled to carry. This condition was particularly true of military aeroplanes designed during and just after the war. Each section, equipment, photographic and armament, wanted to be fully represented by the very latest, largest and heaviest apparatus available. The endeavor to make the same aeroplane serve for light bombing, fighting and observation resulted in the addition of bomb racks, wireless outfits, oxygen sets, cameras and the rest, till the unlucky aeroplane resembled a Christmas tree. Since then the military load for each type has been standardized and is a quantity known in detail at the beginning of the design.

As a consequence of all this there came a strong reaction among many of the best designers to be very conservative in preparing weight estimates. This change in attitude greatly improved the truthfulness of the estimates. Now, instead of the designer having high hopes in regard to performance prediction up to the time the construction of the aeroplane was completed, he often became discouraged at the start of the design, knowing that with the high weight, which experience had taught him was apparently inevitable, a good performance was hardly possible. This reaction had a natural psychological effect on the designer who felt his weights were running so high anyway that it was hardly worth while trying very hard to keep them down. The result was, of course, what one would expect.

Last fall there came to the attention of the Enginering Division a design by one of the leading engineers in the country, that was unique in several respects, but in none more than in its extreme low weight which was about three hundred pounds in twenty-five hundred less than the average weight for that type of aeroplane. By this cut in weight the designer was able to meet the very severe performance requirements which otherwise would have been unattainable. At first his estimates were met with an amused incredulity, tinged with slight impatience, by Government engineers, including the writer, who were accustomed to the high weights of existing aeroplanes. They reasoned first gently, then heatedly with him but he stuck to his figures and offered that very convincing argument, a money guarantee, that he could meet his estimate. He had seen that the only hope of an aeroplane of the type he was working on was in extreme light weight. He had accordingly gone to the very limit, consistent with the Government's severe strength requirements, and used thin gage alloy steel tubing for his fuselage, a deep section for his wings which were externally braced, developed ingenious fittings of high grade steel, used special balsa fairing very cleverly, and made the whole aeroplane small and compact. He had seen a great light and in so doing performed a service to aviation.

The real way to prepare a weight estimate is to make it low, not trusting to Providence the task of keeping ordinary construction within the limits set, but resolutely resolving that not a superfluous ounce shall go into the structure, and especially the non-structural details, then proceeding to make use of the lightest and strongest materials available, to design and redesign the parts till satisfied they are the irreducible minimum so far as weight is concerned.

One caution must be always borne in mind, however: when cutting weight do not, in too great a burst of enthusiasm, make the parts so light as to be flimsy. An aeroplane must stand hard service and must be rigid. B. C. B.



THE NEWS OF THE WEEK



ZR-2 Memorial Service in Westminster

Airmen of the United States Navy and the British Royal Air Force united September 7 in a service for the victims of the ZR-2 disaster "amid the memorials of Great Britain's most illustrious dead," as one of the prayers expressed it, in Westminster Abbey.

Air Commodore Maitland, D. S. O., and Commander Louis Maxfield, U. S. N., were especially mentioned in the official program, but among the mourners no distinction was made, and the wives of ordinary riggers and of scientific experts sat side by side in seats reserved for them. Ambassador Harvey, Vice Admiral Niblack, Rear Admiral Twining and Consul General Skinner were among the well-known Americans seated in the choir. Near them were representatives of the King and Queen, the British Cabinet and the naval, military and air forces. The Lord Mayors of London and Hull and the Mayors of Westminster and Bedford attended in state, and a large number of British flying officers, with rows of ribbons won by hard adventure worn across their tunics, also came to pay tribute to their fellow-aviators.

The general public filled every seat in the nave, hundreds being turned away disappointed. Just before the service began a detachment of sailors from the United States battleship Utah marched in. Near them was another group of American sailors of still more significance. They were all that are left of the crew of the ZR-2, men who were left behind at the Howden aerodrome as she started on her last cruise.

An address was read from the chancel steps by the Rev. H. D. L. Viener, chaplain in chief to the Royal Air Force. He described how the Americans and British air forces had been associated in developing "a once formidable engine of destruction into a pioneer of closer commercial relations," and dwelt upon the horror of the catastrophe when long months of training were over and only the eagerly awaited voyage home seemed to remain.

"The price of progress and the toll of science," he exclaimed, "are bitter enough. Yet, thank God, there is never lack of splendid men ready to do and to dare. It is best so. To be in the forefront of the fight to conquer what half a generation ago was an untried field will ever appeal to our splendid manhood."

As he finished the choir broke into "Mine Eyes Have Seen the Glory of the Coming of the Lord," and never did the old battle hymn seem to come with more appropriateness. The service closed with prayers and a hymn which here is imperishably associated with trials, vicissitudes and triumphs of the great war, "O God, Our Help in Ages Past." Then, after the blessing, the congregation stood motionless as the bugle notes of "The Last Post," wailed through the lofty arches and the American and British national anthems were sung.

Secretary Denby has been advised that the British cruiser Dauntless, which is bringing home the bodies of the officers and men of the navy who lost their lives in the ZR-2 disaster, will arrive in New York late on Sept. 16, or early in the morning of the 17th.

The ship will dock at South Brooklyn and ceremonies will be held on the dock at 2 o'clock Saturday afternoon, Sept. 17. All arrangements in connection with these ceremonies will be made by the commandant of the Third Naval District, Captain C. T. Vogelgesang.

Behnke Wins Chicago Air Derby

Chicago. — Covering the fifty-five-mile course in forty-nine minutes, David Behnke of the Checkerboard Field won the Labor Day Air Derby Sept. 5. Each flyer carried a passenger. Price Hollingsworth finished second, followed closely by John Kiser and James Curran. Charles Dickinson, a sixty-five-year-old pilot, finished only a few minutes behind the winner.

The contestants were rated on reliability and speed. Designated turning points were marked and pilots who failed to turn at spots constituted were charged with fouls.

King Alfonso Secures Plane

Paris.—A Potez biplane, designed and built especially for King Alfonso of Spain, left Villacoublay at 8.50 o'clock, Sept. 5. The builders expect the plane to average 210 kilometers an hour. The plane bears the Spanish royal arms and is destined for the exclusive personal use of Alfonso.

Newspaper Aero Edition

The Rochester *Democrat and Chronicle* has inaugurated an aero edition, which is being delivered to neighboring towns by aeroplane, and which is arousing very great interest in the community. The various parcels for the different towns are dropped by parachute.

Spokane News

Spokane, Washington. — The development of interest in aviation has proceeded steadily in Spokane and vicinity. In one day last week there were 10 planes on the Foster Russell landing field. They included the machines of Fred W. Hungate,

a banker and wheat grower of Pomeroy; Albert Hubbard, a Spokane inventor; Charles E. Stilwell, theater owner; J. G. Rankin, pilot, Walla Walla; W. H. Fouts, an attorney, Walla Walla; David Mathews, Moscow, Idaho; Spokane Industries, C. L. Langdon, pilot; Ralph Beal, Ritzville; and the Bluebird and standard planes of the Russell Company. Half of the visiting planes were flown by their owners or operators.

Four men are employed in setting up a new three-passenger plane for use on the field. It will be of 150 horsepower, equipped with an electric starter and will be ready for the air shortly.

New York Aviators Support LaGuardia

New York aviators who served during the War have organized a committee to further the interests of Major Fiorella LaGuardia, President of the Board of Aldermen, in the coming New York City mayoralty elections. President LaGuardia resigned his seat in Congress during the War to serve in the Army Air Service. He attained the rank of Major, and won several decorations for valor while fighting in France and Italy.

The committee recently met and presented to President LaGuardia at the City Hall a small model aeroplane, symbolical of the new ship of state, and the first communique from the Air Service to the people of New York.

The committee is headed by Jacques M. Swaab, who was cited for gallantry at Metz and Thiaucourt, and is credited with the destruction of 10 German machines, for which he received the Distinguished Service Cross.

American in French Accident

The body of the American who was a victim of the crash of a Strasbourg-Paris aeroplane at Le Bourget has been identified as that of Richard Perkins Parker of Salem, Mass., a son of Mr. and Mrs. George Parker, who with their daughter, Sarah, 13, are now returning to New York on the steamship Paris. Early reports that Mr. Parker was connected with the Morgan, Harjes & Co.'s bank here were denied.

The Parker family arrived on the Continent in July, leaving after a few days for Rome, and returning at the end of August to sail for home. Young Parker went to Strasbourg September 3. His parents have been notified of his death by wireless..

Officials of the aeroplane company blamed the accident upon the failure of the pilot to obey orders.

Ardmore Aero Club

The Aero Club of Ardmore has been organized with the following officers: Dr. Walter Hardy, Pres.; J. B. Champion, Vive-pres.; Harold Wallace, Treas.; and Florence Bradley, Sec. The club is not yet in a position to take up active flying and so for the time being plans to confine its interests to furthering the cause of aviation.

New Oklahoma Field

Report has been received of the establishment of a commercial aerodrome at this city. No details as to the location and ground marking of the field are as yet available, but it is understood that a company will be operating from it and that hangar space, fuel, and oil will be available.

Praeger Honored by Spain

The King of Spain has conferred upon Otto Praeger, of New York City, formerly Second Assistant Postmaster General, and head of the American delegation to the 7th Universal Postal Congress in Madrid last year, the decoration of "Commander with Star of the Royal Order of Isabel la Catolica".

Under Mr. Praeger's leadership the delegates of the twenty-one Latin-American nations joined with the United States and Spain in the creation of a model postal union, cooperating with the Universal Postal Union, but creating a more liberal and more uniform postal administration between the countries involved than the European nations were in a position to agree to in the Universal Postal Congress so soon after the war. Upon his retirement from the postal service last March, Mr. Praeger took up his residence in New York to engage in industrial research and investigation.

In the business world Mr. Praeger is known as the creator of the American Air Mail Service and reorganizer on a business basis of postal administration. As postmaster of Washington, 1914-5, he converted a typical public office into a working business concern. He speeded up the delivery of mail 50 per cent; increased letter and parcel post deliveries and collections throughout the city, and extended the postal facilities to take care of 20 per cent increase in business, at the same time reducing operating expenses at the rate of $37,000 per year.

Personal Par

Sir George H. Fisher-Smith, commissioner for Great Britain of the World Board of Aeronautical Commissioners, is now in New York. Sir George was formerly mayor of Halifax, England.

Benedict Crowell Aero Club Head

Benedict Crowell, former Assistant Secretary of War, was elected President of the Aero Club of America, September 9, to succeed Myron T. Herrick, who resigned when he went to France as Ambassador. Lieut. Col. Harold E. Hartney, who was head of the Civil Affairs in the office of the Chief of the Army Air Service, was elected Executive Secretary, to succeed Captain Maurice G. Cleary. Colonel Hartney commanded the First Pursuit Group on the French front.

Spokane News

Spokane, Wash.—Climbing 12,400 feet in an aeroplane above Spokane and then descending in a nose dive with terrific speed, Patrick Hennessey, 8-year-old son of E. S. Hennessey, recently made a vain attempt to recover his hearing. The flight was made from the Foster Russel aviation field on the Apple way east of town at 3:30 p. m. "Tex" Rankin piloted the 150 horsepower Curtiss plane.

The trip is 14,200 feet above sea level, believed to be a new altitude record here, was made in one hour and fifty-five minutes. The descent was made in two minutes, or at an approximate speed of 75 miles an hour. A large crowd which watched the flight was thrilled as the plane shot downward and the intrepid youngster waved his hand at them and smiled, although his great hope that he might hear again was not realized.



Line up of yachts at the recent Larchmont Regatta. Photographed by the Fairchild Aerial Camera Corporation. In the group are the Vagrant, Glenn Mab, Ohonkara, Dervish, Sonnica, Graybug, and Carolina



Efficient Curtiss Service

We have recently had most favorable reports from users of Curtiss machines concerning the efficient service of the Curtiss Company in the matter of supplying spares promptly. It is a rule, seldom broken, that orders received in the morning mail or by telegraph—if parcel post packages suffice—are despatched that day. Oftentimes if crating is required, shipment is also made that day, and never later than the next day.

Orders received in Garden City for goods which are in stock in Buffalo and not in Garden City, where there is reason to suppose that the party is holding up flying the machine, are delivered from Buffalo that day, Buffalo being notified by wire.

The company has an excellent system of storage, which has been organized during this year at Hazelhurst Field for service parts, and the personnel handling service orders is the most expert available for the interpreting of telegraphic and other communications in this connection.

A Correction

In a recent issue of AERIAL AGE we stated that the Seaboard Consolidated Air Lines had purchased six Fokker limousines for service between New York and Washington. We have since been advised by the Netherlands Aircraft Mfg. Co. that this report is incorrect, and that as a matter of fact the Seaboard Company has not purchased any Fokker machines.

Easter Airlines Incorporated

The Easter Airlines, Inc., has been incorporated in Maryland. The headquarters of the company will be in Baltimore from which they intend to undertake passenger carrying, aerial survey and photography.

The president and manager of the concern is Ewing Easter, and the secretary and treasurer is Robert Strang. Other incorporators include C. I. Reynolds, E. McNeal Shannahan, George Orr, and Elliott Wheeler.

Bryant Represents Aeromarine

Traverse City, Michigan, will be the distributing point for territory north of Grand Rapids for the Aeromarine Airways Co. M. D. Bryant will represent the company in this territory.

Annual S. A. E. Meeting

The Society of Automotive Engineers has announced that its annual meeting will be held in New York City Jan. 10-13, 1922.

The Meetings Committee suggests that members desiring to present papers communicate with the Society offices at 29 West 39th Street, New York, without delay, since it is desirable that the acceptance of all manuscripts be decided by Oct. 1 in order to provide sufficient time for preparation and circulation of the preprints.

Ends 7,491-Mile Flight

Harry Bruno, advertising and sales manager of the Aeromarine Corporation, who landed in a flying boat at Eighty-second Street and the North River, New York City, at 6:35 p. m., September 11, after an interrupted flight over an all-water route from Chicago, believed he had established a distance record for commercial flying boats. He said 7,491 miles was covered in 102 flying hours.

Bruno, D. G. Richardson, pilot, and R. E. Greisinger, mechanic, left New York on July 7 in a flying boat equipped with a 400-horsepower Liberty motor. They arrived in Chicago on August 1, made a side trip to Lake Superior and started on their return from Chicago on August 18. The machine on the return was flown along the American shore of Lake Ontario, while on the outgoing trip it had hugged the Canadian shore. The return trip was uneventful except for rain, which delayed the departure from Albany.

Chambers of Commerce in Erie, Pa., Petoskey, Charleroix, Manistee, Traverse City, Muskegon, in Michigan, and Chicago, Mr. Bruno said, had promised to co-operate with the Aeromarine Corporation in the establishment of airports in their cities.

Virginia Landing Field

There is a good emergency landing field one quarter mile east of Bluemont, Va.

The field is rectangular in shape, 400 yards long north-east-southwest, and 200 yards wide, with short side parallel with the road to Bluemont.

The field is a pasture, slightly rolling in the center, and landing should be made slowly. Gas and oil can be obtained at Bluemont.

Elucidation

We are in receipt of the following letter from Lawrence B. Sperry, of the Lawrence B. Sperry Aircraft Company, which is self-explanatory:

My attention has been called to the paragraph in your issue of August 22nd, page 571, headed, "Turn Indicator Being Used."

One would gain the impression from reading this paragraph that the Pioneer Instrument Company are the originators and developers of the Turn Indicator, and further than that, that their instrument was used by Lieut. VanZandt on his flight from Moundsville to Washington.

I would like to call your attention to the fact that the Sperry Gyroscope Company were the originators of the Gyroscopic Turn Indicator, and that we as their sole licensees have been carrying this work on for some time.

We have sold a quantity of an improved model of this Turn Indicator to the Army and quite a few civilians. The Indicator used by Lieut. VanZandt was one of ours.

We trust you will see fit to take whatever steps you deem advisable to gracefully rectify the impression given in this paragraph.

Gallaudet Secures Prizes

As a result of proposals and models submitted to the United States Army in accordance with its specifications, The Gallaudet Aircraft Corporation has been awarded the following cash prizes for the most practical types of aeroplanes: $3,000 for type 8B two-seater night observation aeroplane; $3,000 for type 10 corps observation aeroplane; $7,500 for type 13 multi-seater, night bombardment aeroplane.

Field at Saratoga Springs

A municipal aviation field has been established at Saratoga Springs, N. Y.

The field is located about three miles north of the city, within easy walking distance of a trolley running into the city. The field is marked by a 10 ft. circle and the initial "S. S." The ground is level and well adapted for use of large as well as small planes. There is a gasoline station located on one corner of the field, and the spacious club house of the McGregor Links is a few hundred yards distant from the field. The field is open to all visiting aviators.

The Wadsworth Bill

(*Concluded from page 32*)

involving aircraft, airdromes, and air stations, their owners, lessees, charterers, and operators licensed hereunder with the right of appeal as in other cases. The law and procedure to be applied in determining such claims or controversies wherever arising, whether on land, water, or in the air, shall conform as nearly as may be to the principles of law and procedure applied in cases of admiralty juridiction. The owners, lessees, charterers, and operators of such civil aircraft, airdromes, and air stations, shall be entitled to the same measures of exoneration from the limitation of liability as are provided for the owners, lessees, charterers, and operators of vessels by section 4281 to 4286, both inclusive, of the Revised Statutes of the United States, section 18 of chapter 121 of the Act of Congress of June 26, 1884, and the Acts amendatory thereof and supplemental thereto; and the rules of the Supreme Court of the United States and of the inferior United States courts relating to limitation of vessel-owner's liability as now in force or as may be hereafter promulgated shall be applicable to claims and controversies involving such aircraft, airdromes, and air stations, their owners, lessees, charterers, and operators.

Sec. 16. That all salaries provided herein and all expenses incurred under the provision of this Act shall be paid out of such money as may be appropriated therefor by Congress.

Sec. 17. That if any portion of this Act be declared invalid it shall not affect any of the other portions thereof which other portions shall continue in full force and effect.

Sec. 18. This Act shall take effect from and after the date of its passage, and all Acts or parts of Acts inconsistent herewith are hereby repealed.

COX-KLEMIN REBUILDS STANDARD WITH MERCEDES MOTOR

A Standard J-1, has been recently rebuilt by the Cox-Klemin Aircraft Corporation, of College Point, L. I., N. Y., with a six cylinder Mercedes motor, as a three seater plane.

This is perhaps the first time that a Mercedes motor has been installed in a Standard J-1, and the resulting ship is a highly satisfactory one.

The Mercedes, 6 cylinder vertical motor, is rated at 160 H.P., at 1250 R.P.M., but turns up 1550 R.P.M., at full throttle, and delivers close to 200 H.P. at this motor speed. This large power gives the ship a great range of speed, maximum speed considerably more than 90 M.P.H., fast climb and tremendous reserve of power, with slow landing speed and perfect stability and balance. The Mercedes-Standard is a most useful all-round ship, suitable for the most difficult flying conditions.

Fully loaded, the machine holds altitude, and good speed at 100 R. P. M., so that it is very suitable for economical cross-country flying.

The balance is perfect, the increased stagger of the upper wing taking care of the weight of the Mercedes motor.

Ample cooling surface is provided by two side radiators.

On a plane now being rebuilt, the motor is cowled in, giving the ship a more streamline appearance.

Two passengers are placed in the front cockpit, and dual control can be provided when seats are slightly staggered.

The photograph shows a front view of the machine, and the close-ups the engine mounting.

Mr. H. E. Dake, a pilot of the Mayer Aircraft Corporation, purchasers of the machine, flew the machine from Long Island to Pittsburgh. The pilot's report after test read as follows:

"I have flown and tested the Standard J-1 plane with Mercedes motor, assembled for Mayer Aircraft Co., by the Cox-Klemin Aircraft Corp., and have found same to be in excellent condition. The ship took off in a very short distance, and climbed fast at full throttle.

"Engine turned 1,550, wide open, with ship level, and 1,450 to 1,500 on steep climb. Due to abundance of power, the ship climbs well at 1,300 R.P.M. and will hold her altitude when loaded, at 1,100 R.P.M.

"With the exception of a slightly excess vibration at full throttle, which is easily remedied, I found the ship to be in perfect condition, a steep climbing, high speed, slow landing plane."



SENATOR WADSWORTH INTRODUCES BILL TO REGULATE FLYING AND DEVELOP AMERICAN AVIATION

SENATOR James W. Wadsworth, Jr., Chairman of the Military Affairs Committee, has introduced a bill (S.2448) to create a Bureau of Civil Aeronautics in the Department of Commerce and to regulate the operation of civil aircraft in interstate and foreign commerce.

Immediate passage of this bill is imperative for reasons of public safety, national security and the improvement of transportation. It is the first step necessary toward the proper advancement of American aviation.

According to a survey made especially for Secretary of Commerce Herbert Hoover by the Manufacturers' Aircraft Association, the 1,200 commercial planes in operation flew a total of 3,250,000 miles in the first six months of 1921. But during this period there were forty serious accidents, resulting in death to fourteen persons and injury to fifty-two. Practically all of the fatalities and most of the injuries might have been prevented through proper regulation.

Commercial aviation, according to the expressed views of the President and the chiefs of the Army and Navy Air Services, and members of Congress of all parties, must be developed to provide a reserve in production on facilities and primary trained personnel from which the military can draw.

It is recognized that commercial aviation, properly encouraged, will provide not only the much-needed reserve for national security, but will contribute greatly to the quickening, the improvement and the cheapening of transportation.

Just as the hazard of such flying as there is today can not be reduced without regulation, so commercial aviation, as an economic factor and military reserve, can not be developed without the establishment of the proper Federal authority.

So pertinent has the subject become that the American Bar Association, at its recent annual meeting, in considering regulatory legislation, urged that such laws as Congress enacts be framed so as to come within constitutional authority. Fortunately the bill introduced by Senator Wadsworth (S. 2448) meets these requirements, as it was framed after careful study of the preliminary report of the Committee on Aviation Law of the American Bar Association, which report anticipated the thought of the National Convention. The bill provides for a Commissioner of Civil Aeronautics, appointed by the President, operating under the Secretary of Commerce. The commissioner's duty shall be: (1) to inspect the design and construction, and, if approved, to license the operation of civil aircraft; (2) to regulate navigation and operation of civil aircraft through the establishment of aerial traffic rules; (3) to promote civil aviation by designating, approving and laying out air routes, encouraging the establishment of landing fields and air stations, by operating weather stations in conjunction with other bureaus, creating communication and signalling systems and by collecting and disseminating information concerning aviation here and abroad; (4) to encourage and undertake research and co-operate with other institutions in that work; (5) to operate such air services as the Department of Commerce may see fit.

In introducing the bill, Senator Wadsworth stated:

"This bill provides for the control, regulation and development of civil aviation. In line with the recommendations made by President Harding in his inaugural message, it establishes a Bureau of Aeronautics in the Department of Commerce, thus providing commercial flying with a centralization already possessed by the Air Services of the Army and Navy. Through control, regulation and development, civil aviation can make a real contribution to our transportation needs, particularly in the carriage of mail, and at the same time provide an economical and indispensable reserve for the military and naval services. This bill was prepared in

response to the urgent solicitation of a score of organizations throughout the United States representing the operating, engineering, constructing, commercial and sporting elements in aviation. Its early enactment is imperative as a means of saving life and property, aiding our economic development and strengthening our national defense."

The bill is now before the Senate Committee on Commerce. Its immediate passage is imperative.

Following is the Wadsworth Bill:

A BILL

To create a Bureau of Civil Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby established in the Department of Commerce under the jurisdiction of the Secretary thereof a bureau to be known as Bureau of Civil Aeronautics.

Sec. 2. That a Commissioner of Civil Aeronautics shall be at the head of such bureau, who shall be appointed by the President by and with the advice and consent of the Senate, who shall receive a salary of $7,500 per annum. There shall be also an Assistant Commissioner of such bureau who likewise shall be appointed by the President by and with the advice and consent of the Senate, who shall receive a salary of $5,000 per annum. The Assistant Commissioner shall perform such duties as may be prescribed by the commissioner or as may be required by law. There shall be also a chief clerk of said bureau, and such other deputies, assistants, and employees, as may be required from time to time and as may be authorized by law.

Sec. 3. That it shall be the duty of the Commissioner of Civil Aeronautics in conformity with the provisions of this Act—

(a) To inspect the design and construction and, if approved, to ilcense the operation of civil aircraft, in order to safeguard life and property.

(b) To regulate the navigation and operation of civil aircraft through the establishment of aerial traffic rules and regulations in order to safeguard life and property.

(c) To foster civil aeronautics—(1) by designating, approving, mapping, and laying out air routes; (2) by establishing and encouraging the establishment of landing fields and air stations; (3) by establishing and operating meteorological services in co-operation with the other departments of the Government; (4) by establishing and operating communication and signalling systems; (5) by studying the development of aeronautics in the United States and other countries and by the collection and dissemination of information relative thereto.

(d) To encourage or undertake such aeronautical investigations and research as may be of value and to co-operate with other institutions to that end.

(e) To co-operate through proper governmental channels with the air staffs or other authorities of foreign governments, for any purpose pertaining to civil aeronautics.

(f) To operate such air services as the Secretary of Commerce may deem necessary for inspecting, licensing, regulating, and controlling the operation of civil aircraft and the mapping and laying out of air routes and airdromes and air stations and the policing thereof.

(g) To establish and administer regulations in conformity with and carrying into effect international aeronautical agreements and treaties.

Sec. 4. That, subject to the approval of the Secretary of Commerce and for the purpose of making effective the provisions of this Act, the Commissioner of Civil Aeronautics shall by regulation provide for—

(a) Licensing pilots and such other persons engaged in the navigation or operation of civil aircraft as may be required for the public safety and when necessary the suspension or revocation of such licenses.

(b) The registration, identification, inspection, certification, or licensing of all civil aircraft and when necessary the suspension or revocation of such licenses.

(c) The registration, identification, inspection, certification or licensing of all civil airdromes or air stations and when necessary the suspension or revocation of such licenses.

(d) The conditions under which civil aircraft may be used for carrying and transporting persons or property, or for the operation of any civil aerial service whatsoever, and the licensing of any such service.

(e) The prohibition of the navigation of civil aircraft over such areas as may be specified for military, naval, postal, or other purposes, either temporarily or permanently, and either absolutely or subject to such exemptions or conditions as may be prescribed.

(f) The manner of using air routes and the utilization of air navigation facilities and appurtenances.

Sec. 5. That all rules and regulations authorized under the provisions of this Act shall be formulated by the Commissioner of Civil Aeronautics and they shall then be recommended to the Secretary of Commerce and upon the latter's approval such rules and regulations shall be promulgated by him and shall have the effect of law and be enforceable from the date of such promulgation unless otherwise provided therein. The Secretary of Commerce, upon similar recommendations, shall have the power to amend, alter, suspend, or revoke such rules and recommendations and to promulgate new rules and regulations from time to time.

Sec. 6. That, subject to the approval of the Secretary of Commerce, the Commissioner of Civil Aeronautics shall cooperate with other departments of the Government to establish the conditions under which persons may be carried and property imported and exported in civil aircraft, from, into, or through the United States, its Territories and dependencies, and to prescribe the areas within which aircraft entering the United States, its Territories and dependencies or the waters thereof, are to alight and the conditions to be complied with by such aircraft.

Sec. 7. That the word "aircraft" as employed in this Act shall embrace every type of flying machine, conveyance, or vehicle now known or hereafter invented, devised, or developed, whether or not used in the carriage or transportation of persons or property, or without persons or property, flown, operated, or navigated in or through the air, and shall include aeroplanes, hydroplanes, seaplanes, balloons, dirigible balloons, and all similar conveyances or vehicles.

Sec. 8. That it shall be unlawful to fly or to navigate or operate any civil aircraft in violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, or to fly or to navigate or operate any civil aircraft in interstate or foreign commerce, or in, over, upon, or along or through navigable streams, rivers, or waters, or post roads or routes of the United States, or the air or atmosphere above the same, or in, over, or through the District of Columbia, the Territories, dependencies, reservations, national parks or over any place or building over which the United States has jurisdiction, or to maintain or operate any airdromes or air station over which the Bureau of Civil Aeronautics may exercise jurisdiction except in conformity with the provisions of this Act and such rules and regulations as may be promulgated pursuant thereto.

Sec. 9. That any violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, shall be punishable by a fine not exceeding $1,000 or by imprisonment for a term not exceeding one year, or both.

Sec. 10. That the provisions of this Act and the rules and regulations promulgated thereunder shall not apply to individuals, aircraft, or airdromes, or air stations under the control of other departments of the United States Government, except where use is made by the personnel or aircraft of such departments, of equipment, airdromes, or facilities licensed and controlled by the Commissioner of Civil Aeronautics, in which instances the rules and regulations promulgated by the Commissioner of Civil Aeronautics shall be observed.

Sec. 11. That the Commissioner of Civil Aeronautics and such deputies as he may designate shall have power to conduct hearings, to subpoena witnesses, to send for documents and other papers, to administer oaths, and to take such testimony as may be necessary in determining the qualifications of individuals for licenses or registration certificates to operate aircraft, airdromes, or air stations, or in the suspension or revocation of such licenses or registration certificates, or to enable him, or them, to make effective any of the provisions of this Act, or any rule or regulation promulgated in conformity therewith.

Sec. 12. That the Commissioner of Civil Aeronautics is authorized, subject to the approval of the Secretary of Commerce, to fix the fees and charges for such inspection, registration, and licensing authorized by this Act, which fees and charges shall be collected by the Commissioner of Civil Aeronautics and covered into the Treasury of the United States to the credit of miscellaneous receipts.

Sec. 13. That the Commissioner of Civil Aeronautics shall prepare and keep available at all times an up-to-date comprehensive survey and inventory of all of the civil and industrial aeronautical resources within the United States, its Territories and dependencies or the waters thereof, and shall publish quarterly a bulletin setting forth all licenses issued, together with field reports of all flying activities, accidents, and field and route data, under the control of the bureau.

Sec. 14. That the Commissioner of Civil Aeronautics shall annually, at the close of each fiscal year, make a report to the Secretary of Commerce, giving an account of all moneys received and disbursed by him and describing the work done by the bureau, and the Secretary of Commerce shall transmit such report to Congress with the annual report of the Department of Commerce.

Sec. 15. That the district courts of the United States shall have exclusive jurisdiction over all claims and controversies

(*Concluded on page* 30)

THE EMPLOYMENT OF AIRSHIPS FOR THE TRANSPORT OF PASSENGERS

Indications on the Maximum Limits of Their Useful Load, Distance Covered, Altitude and Speed*

By UMBERTO NOBILE

Director of Italian Aeronautical Construction

(*Concluded from last week*)

26.—Determination of the Minimum Cubature Required For a Given Trip

The data of the problem are: the number of passengers, n_o, and the distance L_o, to be covered without landing.

In round figures we may take 100 k for the weight of each passenger, comprising therein his part of the weight of the cabin and cabin fittings and also his part of the foodstuffs.

Then, taking V as the unknown cubature, we shall have:

$$\frac{1}{100}\left[f\,V - \alpha\,V^{1/3} - \beta\,V^{2/3} - \gamma\,V - \delta\,V^{4/3} - \frac{L_o}{B\,V^{2/3}} \right] = n_o$$

putting more briefly:

$$B = \frac{A}{100}\,\frac{k}{\eta}\,v^2$$

The preceding equation solved for V, gives the required cubature in function of L_o and n_o.

We may now ask what value of V renders n_o maximum, the value of L_o being established.

Solving the first member of the equation and taking it as equal to zero, we find:

$$f\,V = \frac{1}{3}\,\alpha\,V^{1/3} + \frac{2}{3}\,\beta\,V^{2/3} + \gamma\,V + \frac{4}{3}\,V^{4/3} - \frac{2}{3}\,\frac{L_o}{B\,V^{2/3}}$$

If we compare this equation with equation (4), we see, as we might have anticipated, that the volume V for which n_o is maximum, is always less than that for which Φ is maximum and that the difference of volume between n_o max. and Φ max. is less as the distance L_o is shorter. We may, therefore, deduce that for small values of L_o, the value of V corresponding to n_o maximum is greater than the cubature of minimum consumption. In other words, this cubature cannot, in general, be considered as a limit cubature, as might appear at a first glance.

The use of tables and diagrams gives a rapid solution of the problem, as we shall show by a few examples.

1st. Let us consider the transportation of 100 passengers (weight, 10,000 kg.) in a non-stop flight from Rome to New York, (distance about 7200 km.).

From the table we find that it is not possible to use airships having a maximum velocity of 120 km/h., and still less those of 150 km/h. We will therefore suppose that we have v = 90 km/h., and consequently v_o, normal velocity of navigation, equal to about 71.5 km/h.

Glancing at the table, we may conclude that the required cubature (certainly greater than 60,000 cubic meters since for this value we have L_{max} = 7231 km.) is comprised between 100,000 and 150,000 cubic meters. In point of fact, we have:

for 100,000 m³ $\Phi - c\,L_o = 5{,}800$ kg.
for 150,000 m³ $\Phi - c\,L_o = 12{,}380$ kg.

Considering that we must have: $\Phi - c\,L_o = 10{,}000$, by a simple interpolation we at once obtain:

$$V = \backsim 132{,}000 \text{ m}^3$$

The number of passengers which can be carried over the distance stated above by airships verying in cubature from 60,000 to 350,000 m³, is as follows:

V = 60,000	$n_o = \backsim 1$
V = 100,000	$n_o = 58$
V = 150,000	$n_o = 124$
V = 200,000	$n_o = 182$
V = 250,000	$n_o = 230$
V = 300,000	$n_o = 270$
V = 350,000	$n_o = 300$

2nd. In the previous case, suppose that we make a stop at the Azores for the purpose of taking in fuel. Under these conditions the maximum distance is reduced to about 3,700 km., and the cubature for v = 90 km/h., to 45,000 m³, instead of 132,000 as in the first case.

3rd. Let us consider the line London-Paris-Marseilles-Rome-Naples-Taranto-Cairo, with stops at London, Rome, Taranto and Cairo.

There will be non-stop flights having the following lengths:

London-Rome ..... 1625 km.
Rome-Taranto ..... 460 km.
Taranto-Cairo ..... 1700 km.

Adopting airships of 120 km/h., we find that with a cubature of 50,000 m³ we can carry 80 passengers, and with a cubature of 100,000 we can carry 200 passengers, covering the entire distance in about 40 hours' flight.

4th. Suppose we have a passenger service between Milan in Italy and Alexandria in Egypt (distance about 2,400 km.) operated by airships having a maximum velocity of 120 km/h. and a normal velocity of 95 km/h.

For a non-stop flight, we have at once from the table:

for 40,000 m³ $n_o = 17$
for 60,000 m³ $n_o = 55$
for 80,000 m³ $n_o = 93$

But suppose that we make a stop at Taranto (Milan-Taranto, 875 km.; Taranto-Alexandria, 1525 km.), the maximum distance to be covered in a non-stop flight is reduced from 2,400 to 1,525 km. and we have:

for 40,000 m³ $n_o = 59$
for 60,000 m³ $n_o = 118$
for 80,000 m³ $n_o = 169$

Conclusions

1. The results we have reached in this investigation fully confirm the essential points characterizing the airship: a flying machine relatively slow, but capable of carrying a large useful load over a long distance.

These characteristics are the contrary of those of the aeroplane, which, in the present state of aerial technical data, is a machine essentially fast, but which can only carry a relatively small useful load over a relatively short distance.

There is, therefore, no reason to talk about competition between these two means of aerial locomotion, since they are so essentially different from each other, each having its own definite field of activity, the one serving to complete the other. The co-existence of airships and aeroplanes forms a complete solution of the problem of aerial navigation.

The advantages of airships of large cubature are so evident as to justify the greatest hopes for their immediate future. It should be remarked that it is not too much to hope that the limits we have found, and which are already pretty large, will be exceeded in actual practice, since in our investigation we have abstained from considering the developments which may confidently be expected from the genius of inventors and the skill of constructors.

Even without taking these probable developments into account, though they are by no means negligible quantities, we see that there is a certain limit to the advantages of large cubature.

This limitation is due, essentially, to the gradual decrease of the coefficient of utilization and *consequently of the maximum altitude of flight.* By increasing the cubature beyond the point corresponding to ρ maximum, (which our calculations show to be much smaller than is commonly believed), the maximum altitude of the airship goes on decreasing, in spite of the fact that the range of action in a horizontal plane and the useful load go on increasing.

Now, the possibility of rapid climb is undoubtedly an essential factor of security of aerial navigation in the case of storms.

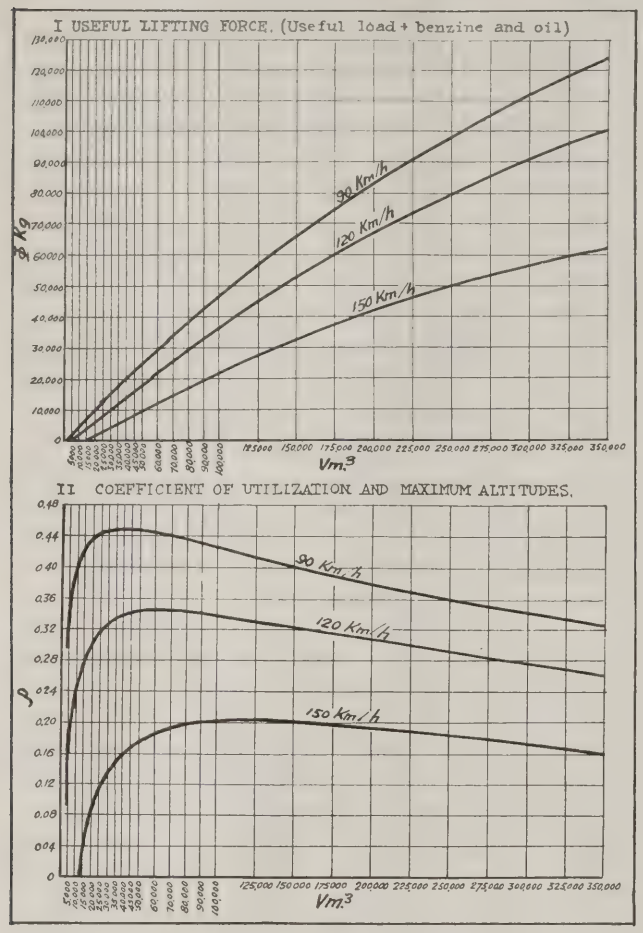
The other factor of security is velocity. To run ahead of a storm is another way of avoiding it.

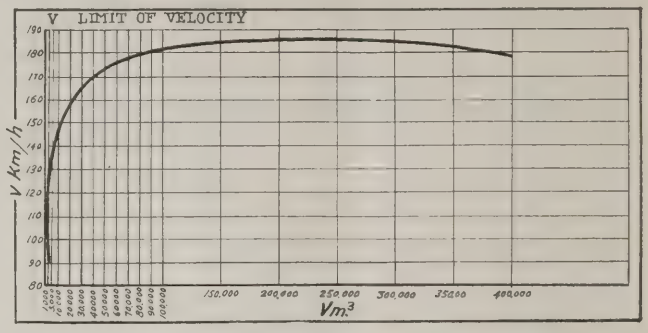
High altitude and high speed are, however, antithetical terms. It it possible to build airships capable of rising to high altitudes, but they will, necessarily, have low velocity, just as it is possible to build airships having high speed, but having a low ceiling.

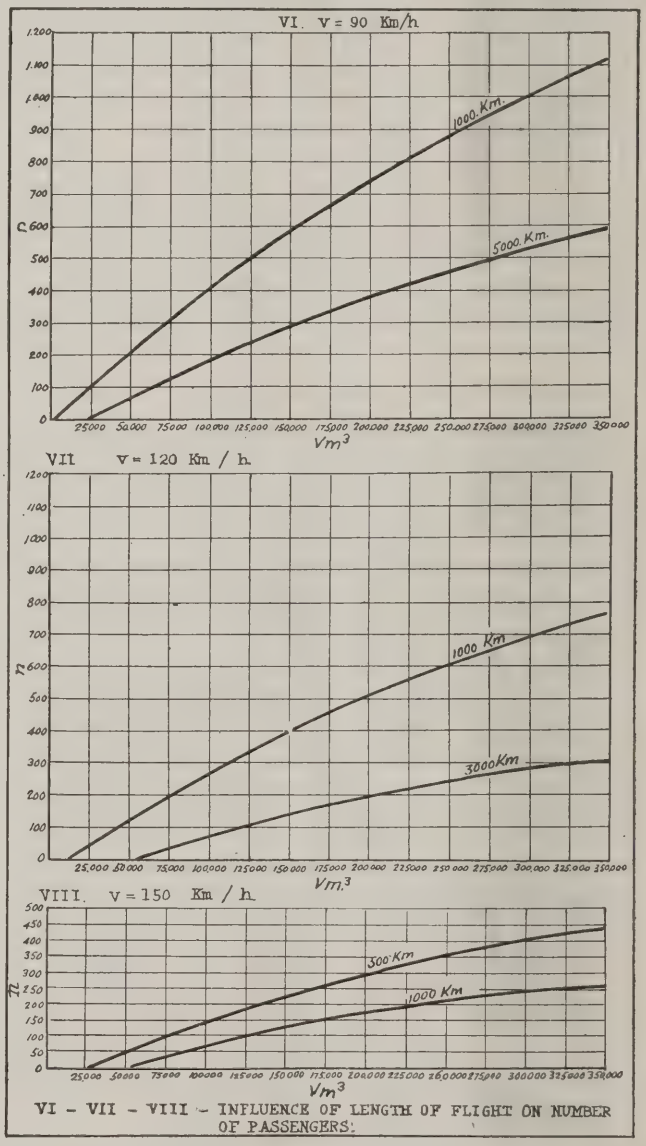
Our investigation leads us to conclude that a maximum velocity of 120 km/h. is as far as we ought to go. This figure can only be exceeded by excessive reduction of altitude of ceiling, range of flight, and useful load.

Now, at 120 km/h., for a cubature of 200,000 cubic meters, we have a coefficient of utilization of 0.31, which, including the 300 m. of initial rise, corresponds to a ceiling of about 4,000 m. altitude, reached, however, with a zero useful load and at the end of the flight only, after having consumed the entire supply of benzine and oil. This ceiling is evidently of relatively low altitude, and we should therefore consider the advisability of exceeding the above given cubature for airships of this type.

Of course, with decreased velocity there would be an improvement. For instance, with the same cubature of 200,000 cubic meters and a speed of 90 km/h., the ceiling would be at about 5,000 m. The gain in altitude would not, however,







VI - VII - VIII - INFLUENCE OF LENGTH OF FLIGHT ON NUMBER OF PASSENGERS.

altogether compensate for the pronounced decrease of maximum velocity.

2. We will now consider the use of the airship in a public passenger service.

The essential requisites of a public transport service are safety and regularity of service.

The first of these requirements can undoubtedly be met. We have only to adopt a cubature large enough for realizing the following three conditions: (a) the certainty of being able to rise rapidly to a height of 1500 or 2000 m. right at the beginning of navigation; (b) a fuel reserve sufficiently ample to enable the ship to sail for much longer than the anticipated time, should this be required by the atmospheric conditions; (c) the possibility of developing a relatively high maximum speed.

When these three conditions are satisfied we may say without fear of exaggeration that *aerial navigation by airships is safer than maritime navigation.* As a matter of fact, a ship on the water cannot rise above the gale as an airship can.

The necessity of satisfying all three conditions at the same time, leads us to conclude, on the basis of our calculations, that under the present conditions of aerotechnics it is not advisable with airships used for passenger service, to exceed a normal flying speed of 80 or 90 km/h. or a non-stop flight of more than 3000 to 4000 km. In other words, we are convinced that the best cubature to adopt is not that which aims at increasing the length of non-stop flights or of the speed of flight, but rather that which aims at safety in navigation by increasing the supply of benzine and the amount of ballast.

The requisite of regularity, meaning thereby starting and arriving at schedule time, is, for the airship, intimately connected with the question of safe navigation, since, when this is assured we may, in a large measure, count on the flight being accomplished within the stated time. It cannot, however, be denied that, aerial navigation being still largely dependent on atmospheric conditions, a strict adherence to schedule time can only be guaranteed if the service is limited to the most favorable season of the year, though it may be remarked that the regularity of the maritime service is also influenced by weather conditions in a certain measure.

We may hope that airships will be much less affected by weather conditions when, in the near future, the problem of mechanical mooring, housing, and getting the ship out of its hangar, has been satisfactorily solved.

3. It is thus possible to assure an airship service offering the most absolute guarantees for security of flight and also, within practical limits, regularity of service. We must now consider the question from the economical point of view.

We do not deem it necessary to enter here into an analysis of the unit cost of aerial transportation, but we may certainly affirm that, in most cases, the cost of aerial transport will necessarily be greater* than transport by land or water, especially when, as in a public service, satisfactory regularity and absolute safety are required.

But in judging the economical aspect of transportation, we must consider not only cash outlay, but also another essential factor, namely, speed.

Considering the question from this point of view, we shall not be so foolish as to pretend that the airship competes with the railway or motor-car unless (and such cases are not rare) over difficult or mountainous country or where business is limited. In these cases the aerial service would show a considerable saving of time as compared with other means of transport, either on account of the airship being able to take the most direct route or on account of greater speed.

Also, we need not be surprised if in such characteristic cases the cost of aerial transport should prove to be less than the cost of transport by rail or motor-car. For instance, if the line is intended to link up two places difficult of access, far distant from each other, and having only sufficient business to warrant, say, a bi-weekly service. Under these conditions it is quite certain that the cost of establishing and running an aerial line would be much less than that of laying a railway or making routes for motor-cars.

Except for the exceptional cases just mentioned, we believe that *an aerial service with airships is especially and particularly suitable for flights over large expanses of water.*

We must here distinguish between short distance and long distance flights.

In the first case, it is evident that we can attain a high flying speed, thereby obtaining a considerable advantage over the usual maritime service, whether over seas or lakes. Such may be the case, for instance, for a line Rome-Cagliari, or Rome-Tripoli, or Rome-Palermo.

For a longer distance, we must, on account of the reasons given above, reduce our speed, but, in any case, we may take it that the journey will be completed in about half of the time required by the fastest ships.

The question now arises whether this gain in speed as compared with maritime navigation is such as to compensate for the greater cost and the inevitable decrease in comfort.

The answer to this query cannot be doubtful. When the safety of the journey is assured and there are regular departures (two conditions which, as we have seen, can be complied with) passengers will certainly not be lacking.

Concerning the question of departures at stated times, we may remark that for long journeys over the sea, punctuality in leaving according to a pre-aranged time-table is of less importance than for short journeys. That is to say, the departure of an airship need not be announced much ahead of the time, nor need the departures be arranged according to a fixed time-table. It will be sufficient if the time of departure is announced two or three days beforehand, so as to give intending passengers time to prepare, and to decide whether they will travel by air or by the usual maritime service. This consideration is of some importance, since it meets the objection raised that aerial transport being, as it is, dependent on the weather, cannot compete commercially with maritime navigation.

4. *The airship for tourists.*

In this field the airship has a unique position, surpassing even the aeroplane. The airship tourist service cannot fail to develop and flourish since it requires only a small capital and combines large profits with absolute security of investment.

*And greater generally with aeroplanes than with airships. This statement may seem, at first sight, rather paradoxical, but it can easily be proved by even a summary analysis of the cost of transport.

Such a service is especially important in countries like Italy, where there is always a great influx of visitors from abroad. We are convinced that a well organized system of touring airships, especially in tourist centers, would not only be successful from an investor's point of view, but would also react favorably on the general economic conditions of the country.

The following considerations justify the theory that a tourist service with airships is capable of being developed under the most favorable conditions.

1st. The sensation of absolute security given by an airship in comparison with that felt in other modes of flight, cannot fail to attract a large number of tourists.

2nd. For passenger transport the airship offers much greater convenience and comfort than the aeroplane; also, the airship can slow down during flight or even remain stationary in the air, thus allowing greater enjoyment of the panorama.

3rd. The risks of navigation are reduced to a minimum, or even altogether eliminated, since the tourist service will only operate in suitable weather.

4th. The cost of terminal stations, material and personnel are reduced to a minimum, especially for short distance flights such as Rome-Naples, Bay of Naples, the Italian Riviera, Sicily, etc. For longer flights, such as Rome-Constantinople, Rome-Cairo, Rome-Paris, etc., these items will amount to more.

5th. Considering the class of passengers who will be catered for, the rates charged may be fixed at a sufficiently remunerative figure.

5. *Rigid and semi-rigid airships.*

We will conclude this study by a rapid comparison between the two types of airships which are today contending for supremacy: the semi-rigid Italian type and the rigid German type.

Of the Italian semi-rigid type there are two classes, one having an articulated longitudinal beam, the other, a rigid longitudinal beam.

While for small cubatures, the absolute superiority of our articulated beam type is generally recognized (and proved by the numerous requests from foreign Governments for sample airships of this type and the appreciations of them expressed in the official organs of those Governments,*) many experts and especially many amateurs maintain that, even for large cubatures, the Italian semi-rigid type can successfully compete with the German rigid type.

Though there may be a doubt in the matter as regards the articulated type, there can be none whatever as regards the rigid type, as shown by the brilliant success of our experience with our first T type airship. We are convinced that to whatever dimensions our T type may be increased (within the limits suggested in this study) we shall always find that the particular characteristics which constitute its fundamentally good qualities are not only preserved, but even accentuated.

Of course, we do not say that great increase of cubature can be made without giving rise to difficulties. When the cubature exceeds 100,000 cubic meters the problems of construction and assemblage take on a certain importance, but though these problems may be difficult of solution they are never such as to lead to unfavorable conditions.

We consider that the essential reason why our type is superior to the German, lies in the conception of the rigidity itself. In the German type, the whole of the external surface is made rigid, even where the natural pressure of the gas is sufficient to preserve the shape. The Italians only make rigid those parts which really require such treatment, thus greatly simplifying construction and assembling which more than compensates for the slight disadvantage of a less penetrating form. Moreover, as regards the preservation of the form, the rigid type does not appear to have much advantage over the Italian semi-rigid, since, with the rigid bow of the T type the excess pressure of the gas in the envelope can be maintained relatively low, without fear of any inconvenience arising either during navigation or during mooring operations.

The superiority of the Italian conception appears, however, not merely in simpler construction, but also, and more especially, in greater strength. This is evident when we compare the *huge, delicate, fragile arrangement* formed by the metallic framework of the Zeppelins with *the strong, elastic backbone* formed by the longitudinal beam of the Italian type. This backbone is *strong* because its parts, being relatively small and exposed to great forces, have a resistance which we shall

*Our Aeronautical Construction Works has just completed an M type airship for England, and two O types, one for the U. S. A., the other for the Argentine. Another of the same type is being built for Spain. The O type, derived from the P type, (Crocco-Riccaldoni) may be considered as the most successful of Italian small cubature airships. It was designed by Engineers Pesce and Nobile.

TABLE I.

Weight of the Various Parts of the Airship in Function of Volume and Speed

$P = V^{1/3} + (\beta' + \beta'' v^3) V^{2/3} + (\gamma' + \gamma'' v^2) V + \delta V^{4/3}$

(P in kg.; V in m.³; v in km/h.)

Parts	$\alpha V^{1/3}$	$\beta V^{2/3}$	
		β'	$\beta'' v^3$
Envelope with all accessory organs including valves and valve controls.		2.410	
Stiffening of bow			
Stabilizers and rudders with controls			
Longitudinal Beam			
Accessories of longitudinal beam (covering, gangway, shock absorbers)		0.374	
Power plant with supports			10^{-6} 3.15 v^3
Maneuvering devices			
Plant for lighting, wireless, ventilators	4.5	0.190	
Pilot's cabin		0.300	
Crew	20.0		10^{-6} 0.20 v^3
Engine spare parts and tools			10^{-6} 0.16 v^3
Reserve ballast and ballast for initial climb of 300 m.			
	$\alpha = 24.5$	$\beta' = 3.274$	$\beta'' = 10^{-6}$ 3.51

TABLE I. (Cont.)

Weight of the Various Parts of the Airship in Function of Volume and Speed

$P = V^{1/3} + (\beta' + \beta'' v^3) V^{2/3} + (\gamma' + \gamma'' v^2) V + \delta V^{4/3}$

(P in kg.; V in m.³; v in km/h.)

Parts	γV		$\delta V^{4/3}$
	γ'	$\gamma'' v^2$	
Envelope with all accessory organs including valves and valve controls	0.008		0.00374
Stiffening of bow		10^{-6} 1.3 v^2	
Stabilizers and rudders with controls	0.047		
Longitudinal Beam	0.022	10^{-6} 0.5 v^2	0.00236
Accessories of longitudinal beam (covering gangway, shock absorbers)			
Power plant with supports	0.003	10^{-6} 1.3 v^2	
Maneuvering devices			0.00060
Plant for lighting, wireless, ventilators	0.007		
Pilot's cabin			
Crew	0.003		
Engine spare parts and tools			
Reserve ballast and ballast for initial climb of 300 m.	0.070		
	$\gamma = 0.160$	$\gamma'' = 10^{-6}$ 3.1	$\delta = 0.0067$

seek in vain in the framework of the Zeppelin. It is *elastic*, because its articulated joints, the peculiar characteristic of our longitudinal beam, give it an elasticity which enables the airship to withstand shocks and bumps, while the Zeppelin, as experience has proved, cannot support such shocks without serious damage.

These are the two most important advantages of the Italian type over the German type. We may also mention the following:

TABLE II.

Maximum Velocity, 90 km/h.

Normal Velocity of Flight, about 72 km/h.

Cubature V m³	Useful lifting force (for f = 1100 kg/m.³ Φ kg.	Coefficient of utilization ρ	Fuel and oil per km. c kg.	Limit distance L km.	No. of passengers for 1000 km.	No. of passengers for 5000 km.
5,000	1,877	0.3411	0.772	2,431	11	0
10,000	4,472	0.4005	1.226	3,647	2	0
15,000	7,095	0.4300	1.606	4,418	55	0
20,000	9,700	0.4409	1.946	4,985	77	0
25,000	12,275	0.4463	2.258	5,436	100	0
30,000	14,813	0.4489	2.550	5,809	123	21
35,000	17,312	0.4497	2.826	6,126	145	32
40,000	19,775	0.4494	3.089	6,402	167	43
45,000	22,202	0.4485	3.341	6,645	189	55
50,000	24,589	0.4471	3,584	6.861	210	67
60,000	29,264	0.4434	4.047	7,231	252	90
70,000	33,806	0.4390	4.485	7,538	293	114
80,000	38,226	0.4344	4.903	7,796	333	137
90,000	42,406	0.4283	5.304	7,995	371	159
100,000	46,699	0.4245	5.690	8,207	410	182
125,000	56,693	0.4123	6.602	8,587	501	237
150,000	66,083	0.4005	7.456	8,863	586	288
175,000	74,923	0.3892	8.263	9,067	667	336
200,000	83,258	0.3784	9.032	9,218	742	381
225,000	91,118	0.3681	9.770	9,326	813	423
250,000	98,541	0.3583	10.480	9,403	881	461
275,000	105,548	0.3489	11.169	9,450	944	497
300,000	112,164	0.3399	11.835	9,477	1,003	530
325,000	118,407	0.3312	12.484	9,485	1,059	560
350,000	124,299	0.3229	13,116	9,477	1,112	587

TABLE III.

Maximum Velocity, 120 km/h.

Normal Velocity of Flight, about 95 km/h.

Cubature V m³	Useful lifting force Φ kg.	Coefficient of utilization ρ	Fuel and oil per km. c kg.	Limit distance L km.	No. of passengers for 1000 km.	No. of passengers for 3000 km.
5,000	758	0.1378	1.373	552	0	0
10,000	2,654	0.2412	2.179	1,218	5	0
15,000	4,678	0.2835	2.855	1,638	18	0
20,000	6,737	0.3062	3.459	1,948	33	0
25,000	8,802	0.3200	4.014	2,193	48	0
30,000	10,858	0.3290	4.532	2,396	63	0
35,000	12,895	0.3349	5.023	2,567	79	0
40,000	14,914	0.3389	5.491	2,716	94	0
45,000	16,911	0.3416	5.939	2,847	110	0
50,000	18,881	0.3433	6.371	2,963	125	0
60,000	22,751	0.3447	7.195	3,162	156	12
70,000	26,522	0.3444	7.973	3,326	185	26
80,000	30,197	0.3431	8.716	3,464	215	40
90,000	33,691	0.3403	9.428	3,574	243	54
100,000	37,246	0.3386	10.114	3,683	271	69
125,000	45,553	0.3313	11.736	3,881	338	103
150,000	53,335	0.3232	13.252	4,025	401	136
175,000	60,629	0.3149	14.687	4,128	459	166
200,000	67,468	0.3066	16.055	4,202	514	193
225,000	73,873	0.2985	17.365	4,254	565	218
250,000	79,877	0.2905	18.630	4,287	612	240
275,000	85,496	0.2826	19.852	4,307	656	259
300,000	90,752	0.2750	21.037	4,314	697	276
325,000	95,660	0.2676	22.190	4,311	735	291
350,000	100,237	0.2604	23.314	4,299	769	303

1st. Rapidity and certainty in designing.

2nd. Rapidity of construction and utilization of materials of current use and constant characteristics.

3rd. Great rapidity and simplicity of mounting.

4th. Possibility of taking the airship to pieces rapidly either for purposes of storage or transport when it is not advisable to send it under its own power. We may note that the Zeppelin cannot be taken apart.

5th. Possibility in the future of assembling the airship outside the hangar. In fact, the assembling of our longitudinal beam complete with all its accessories, comprising the stiffening of the bow, the power plant, rudders, etc., can be done without inconvenience in the open air if it is protected from the weather by a temporary covering of limited dimensions. When the rigid part is assembled we can, given favorable conditions and fine weather, proceed rapidly to the inflation of the envelope and to its connection with the rigid part. After

TABLE IV.

Maximum Velocity, 150 km/h.
Normal Velocity of Flight, about 119 km/h.

Cubature V m³	Useful lifting force Φ kg.	Coefficient of utilization ρ	Fuel and oil per km. c kg.	Limit distance L km.	No. of passengers for 500 km.	No. of passengers for 1000 km.
5,00	− 1,063	−0.296				
10,000	− 239	−0.026				
15,000	772	0.0468	4.461	173	0	0
20,000	1,957	0.0889	5.406	362	0	0
25,000	3,210	0.1167	6.271	512	1	0
30,000	4,496	0.1362	7.083	635	10	0
35,000	5,800	0.1506	7.848	739	19	0
40,000	7,113	0.1617	8.579	829	28	0
45,000	8,428	0.1683	9.279	908	38	0
50,000	9,735	0.1770	9.955	978	53	0
60,000	12,331	0.1868	11.242	1,097	67	11
70,000	14,883	0.1932	12.458	1,195	87	24
80,000	17,384	0.1975	13.618	1,276	106	38
90,000	19,742	0.1994	14.730	1,340	124	50
100,000	22,192	0.2017	15.802	1,404	143	64
125,000	27,850	0.2025	18.337	1,519	187	95
150,000	33,115	0.2007	20.707	1,599	228	124
175,000	37,993	0.1974	22.948	1,656	265	150
200,000	42,497	0.1932	25.085	1,694	298	174
225,000	46,638	0.1884	27.134	1,719	331	195
250,000	50,335	0.1830	29.109	1,729	358	212
275,000	53,899	0.1782	31.019	1,786	384	229
300,000	57,045	0.1729	32.871	1,735	407	242
325,000	59,883	0.1675	34.673	1,727	425	252
350,000	62,426	0.1621	36.429	1,713	442	260

this, the airship may be ready in a few days, if not to fly, at least to be moored so that the final adjustments may be made without danger.

6th. Great facility of inspection and repairing of single metallic parts. This considerable advantage arises immediately from the fact that the rigid part occupies only a small space, and also that the various parts are articulated together, so that a damaged part can easily be changed.

7th. Lower cost of construction and assembling. We need not dwell on this point. Greater rapidity of construction and assembling together with the use of current materials must conduce to a lower cost of production.

This advantage, however, must be set off against the cost of operation. As a matter of fact, in the Italian type, when, from any cause, the gas bag becomes inefficient, it must be entirely renewed. It is certain that to change one of the gas compartments of the Zeppelin is a much less costly operation, but, on the other hand, when we consider that the cost of upkeep of the rigid part is much less in the Italian type, we come to the conclusion that, on the whole, the upkeep of a Zeppelin is more costly than the upkeep of an Italian airship.

In summing up all the advantages of an Italian airship over a Zeppelin, we must, however, admit that in one point the latter are superior, namely, in the coefficient of head resistance. But we are convinced that this inferiority will soon be eliminated by successive improvements in the Italian type of airships.

Rome, December, 1920.

Translated by Paris Office, N. A. C. A.

THE NIEUPORT-DELAGE BIPLANE, TYPE 30-T

THE Nieuport-Delage biplane, type 30.T, represents the development of the Nieuport "Berline" exhibited at the Paris Aero Show in 1919-20, which was supposed to have been used on the London-Paris airway, but so far has never arrived in this country. The 30.T. was built by the Etablissements Nieuport for participation in the Grand Prix de l'Aero Club de France, but owing to some parts of the Darracq-built Sunbeam-Coatalen engine being made in England it was disqualified under the rule that the whole of the aircraft and engine had to be of French manufacture.

The principal modifications in the 30.T. appear to consist of refinements in streamlining with a view to obtaining an economical speed, and it is claimed that a higher speed has been obtained thus with an engine of similar horse-power.

The fuselage is rectangular section, tapering to a knife-edge aft, and embodies in it, like so many commercial machines, two forms of construction. From the nose to the rear of the passenger saloon the longerons are three-ply covered, thereby leaving this portion free from obstructions. The rear half of the fuselage is built up in the usual manner and is wire braced. The duralumin engine bearers are carried on two transverse formers or bulkheads. The engine is a 420-h.p. Sunbeam-Coatalen built at the Darracq works at Suresnes (Seine). The normal b.h.p. is 420 at 2,000 r.p.m. The airscrew is a four-bladed Chauvière. Three Lamblin radiators are mounted under the fuselage between the front legs of the undercarriage.

The pilot's cockpit is situated behind the engine, the pilot being seated on the left side. Under the pilot's cockpit are the main fuel tanks, an auxiliary gravity tank being mounted in the centre section. Auxiliary and main switches, starting magneto and pumps are situated within easy reach of the pilot, so that he can start up without any assistance.

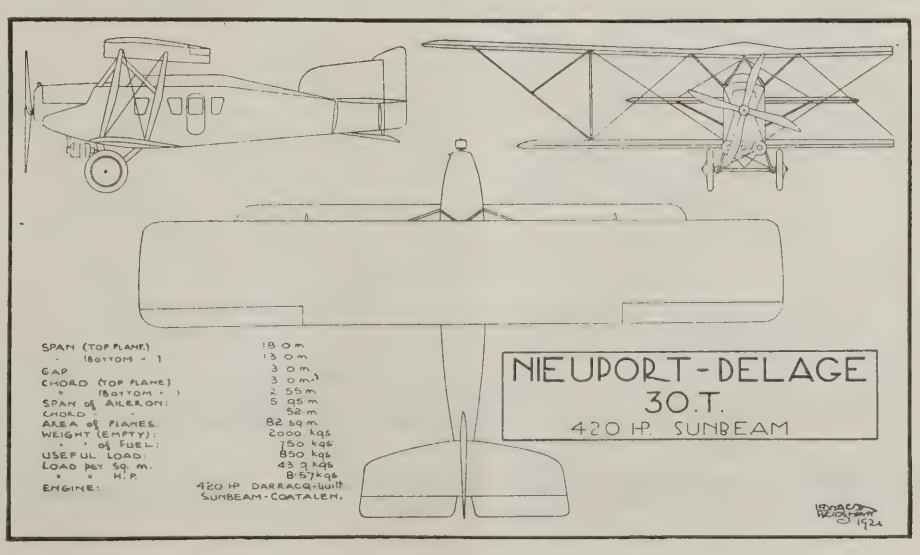
The cabin is very roomy and has accommodation for six passengers. Access to the cabin is by means of a door on the left side, a folding ladder being carried. Accommodation for a wireless operator and his instruments is made in the rear of the passenger cabin.

The undercarriage is of high tensile steel tube streamlined with wooden fairing.

The wings are of fairly thick section, the top plane having considerable backstagger. The centre section is mounted on a cabane, resembling that of the 1½ strutter, with the exception that viewed from the side the struts form the letter N. One pair of interplane struts are fitted either side of the fuselage, but owing to the top plane having considerable overhang, an additional pair of light struts run from the base of the main struts to a point about two-thirds along the overhang. These struts are braced from their centre to the top of the main struts.

Ailerons are fitted to the top plane only.

The tail unit consists of a large fixed tail plane and unbalanced elevators and a large fin and a balanced rudder.—*The Aeroplane*, Aug. 24, 1921.



Governor Allen Flies from Philadelphia to New York

Governor Henry J. Allen, of Kansas, is now a greater advocate of aviation than ever before. A Fokker limousine machine September 12 deposited him at Mitchel Field, Mineola, after making the flight from Philadelphia in an hour.

He was the guest at luncheon of the Philadelphia Chamber of Commerce, and at the suggestion of its members made the aeroplane trip to New York. He was accompanied by V. E. Scott, A. G. Paige, George Howard and Colonel John H. Jackson.

Governor Allen was pleased with the speedy trip, and said that upon his return home he would urge the establishment of air routes between the large cities of Kansas.

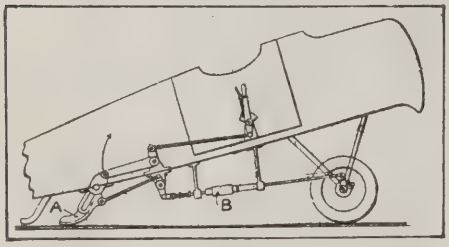


FOREIGN TECHNICAL DIGEST



An Automatic Brake for Aeroplanes

Among those who have been giving their attention to the subject of stopping an aeroplane in the shortest space, after it has landed, is Mr. James E. Mardon, who was led to think over the problem during the War, and has taken out a patent (No. 139,854/19) for his invention. One of the most serious difficulties in the way of fitting a brake to the wheels of aeroplanes is that of making certain that the full force of the brake cannot be suddenly applied—with disastrous results to such a fragile structure as an aeroplane. That has been the defect from which many of the designs of wheel-brakes for aeroplanes tried in the past have suffered—they tend to turn the machine over on its nose. Realizing this, Mr. Mardon has devised a scheme of brakes operating on the aeroplane wheels, in which, while the brake-lever brings the brake-system into operation, it only does that, the brake itself being gradually applied with a gradually increasing pressure through the action of a dash-pot or some similar device.



A further development of the device is shown in the drawing; here the brake is automatically applied as the machine lands. A hand brake-lever of the usual type is employed, and when it is in the "off" position the special skid A is drawn up clear of the ground, but when it is put in the "on" position this skid is lowered, so that it can make contact with the ground before the tail skid proper touches. From this it will be seen that the brakes are not applied by the movement of the lever; that only brings the brake-skid, as it may be termed, into position so that it can automatically apply the brakes on the wheels when the machine lands. In this arrangement, as in the hand-operated design, there is a dash-pot, B, which allows for the gradual application of the brake, thus preventing any violent retardation with its risk of overturning the machine. In the diagram the brake shown is of the hand variety, but it need hardly be said that the system can be adapted to any type of brake acting on the wheels. Similarly it is possible to vary the arrangement of brake-lever or to utilize other methods of putting the system in operation, according to circumstances.

—*Flight.*

Some Recent Farman Aeroplanes

Like most surviving aeronautical firms of long standing and experience, both in this country and in France, the Maison Farman have been turning out from time to time new or modified types of aircraft suitable either for commercial or military use. Their most noteworthy effort since the armistice is undoubtedly the "Goliath," designed towards the end of the war as an "avion de bombardement" and converted into an extraordinarily efficient passenger-carrier, as its consistent good work on the London-Paris service has demonstrated, its regularity of arrival and departure being on an equality with that very trustworthy article the cheap German alarm clock.

Quite recently the two-engined "Goliath" has been modified to take three 265-h.p. Salmson engines, the additional engine being carried in the nose of the fuselage. A machine of this type, which is a standard "Goliath" in all other respects, recently completed the tests organized by the Service Technique de l'Aéronautique.

The following performance figures were obtained in the course of these tests: Total weight 5,000 kg.; Speed at 2,000 m. 160 km.p.h.; Speed (min.) at 3,000 m., 110 km.p.h.; Useful load, 2,200 kg.; Ceiling, 4,550 m.

Of the smaller type of aircraft, the type F.70 is a single-engined biplane. It is fitted with either a 300-h.p. Renault or 265-h.p. Salmson engine, and can either be used as military machine fitted with two machine-guns, or with slight alterations as a commercial machine, for which it is fitted with a comfortable saloon for four passengers.

The type T.O.E. is similar to the F.70, but is fitted with the 300-h.p. Renault engine. In appearance it possesses most of the features common to the "Goliath," in having the same form of fuselage, the same shape of tail-unit, square-cut wing-tips, streamlined vees to the undercarriage, etc.

The 300-h.p. Renault is mounted in the nose, and has two long narrow radiators mounted one in front of each front centre-section strut. Behind the engine are carried the main petrol-tanks, and in rear of these, behind a fireproof bulkhead, is the cabin for six passengers. The pilot is situated in rear of the cabin, in a position similar to that found in the D.H.18 and the Potez IX.

The wings are of fairly thick section, and are without stagger or dihedral. One set of interplane struts are mounted on either side of the fuselage. Ailerons of unbalanced type are fitted to the top plane only. The tail-unit is conventional, all surfaces being unbalanced, but the tail plane is fitted with gear to enable the angle of incidence to be varied during flight.

The undercarriage consists of two N's of wood streamlined with three-ply, connected by a steel tube axle upon which are mounted two "Palmer" wheels, 800 by 150 mm., suspended on rubber cord.

The principal dimensions are:—

Span 13.9 m.; Chord 2.3 m.; Gap 2.3 m.; Length overall 9.4 m.; Surface 62.2 sq. m.; Weight (empty) 1,000 kg.; Weight (loaded) 2,000 kg.; Weight per h.p. 6.6 kg.; Weight per sq. m. 32.5 kg.

Since the war Farman Frères have taken over the construction of the Georges Levy flying-boats. Two of these are now being produced as Farman flying-boats, one with one 450-h.p. Renault engine, and one with three 350-h.p. Panhard engines.

The 450-h.p. boat is of the central boat-built hull type. The hull is built up of an ash framework covered with mahogany planking triple for the bottom forward and double for the sides and bottom aft. For parts of the hull upon which there is no strain, three-ply birch is employed. The hull is divided into a number of water-tight compartments. Easily detachable tanks are carried in the hull, and contain sufficient fuel for a four hours' flight at full power.

The wing cellule is of biplane form and folds backwards on the rear spar, fitting at the centre-section, the wing bracing not being interfered with during the folding operation.

The tail is of monoplane type.

The engine, a 450-h.p. Renault, is mounted on a series of ash struts and bearers, and drives an ungeared pusher air-screw. All engine controls are of direct pull-and-push type.

The wing-tip floats have a capacity of 300 litre, and are fitted with drain cocks.

This boat possesses a useful load of 1,000 kg., a top speed of 170 km.p.h., and climbs to 2,000 metres in 15 mins.

The three-engined boat has been built to the order of the French Navy, and has recently been tested at the French Centre d'Aviation at St. Raphael. The construction follows the practice found on the 450-h.p. boat.

Specification:—Span 33 m.; Length 18 m.; Surface 200 sq. m.; Chord 3.6 m.; Weight (empty) 4,500 kg.; Useful load 2,500 kg., including 500 kg. of bombs; Speed 145 km.p.h.—*The Aeroplane,* Aug. 24, 1921.

New Italian Airship

The French Government is reported to be investigating a new lighter-than-air flying machine which is under construction at Naples. Using no gas, it is based upon the principle of the lightness of rarefied air. By a variable exhaustion of air in a series of envelopes, levitation is obtained.

The machine is the invention of two Italians, Vaugeau and Gargiulo. They do not form anything like a perfect vacuum, but by a system of enclosed reservoirs, the center one of which has the greatest rarefication, they say that they have obtained the result that the pressure of the outside atmosphere is lessened to a degree which makes the frail envelope practicable.

There are three features of the construction. The first is a double envelope one part with another. In the outside envelope an atmosphere of seven-tenths is maintained, whereas in the center envelope the air is much more rarefied. The layer of seven-tenths atmosphere weakens the outside pressure upon the interior of the balloon, which exercises the levitation force.

The second feature is a series of hollow beams forming the frame of the machine, through which compressed air circulates in a manner to exert a counteracting pressure against the outside atmosphere.

The third feature makes use of air heated by the motors to obtain a further decrease of the outside pressure.

Professor Garuffa, an Italian expert, holds that the new machine means a revolution in flying. It will do away with the expense of the use of hydrogen and, it is said, will greatly reduce the crews needed.

The inventors say that the machine when perfected can make 350 miles an hour with 750 horsepower.

NAVAL and MILITARY AERONAUTICS

Opening of Air Service R. O. T. C. Camp

The first Air Service Reserve Officers Training Camp opened at Post Field, Fort Sill, Oklahoma, on June 16, 1921, thereby marking development in the Air Service preparedness program. There are thirty-one students at the camp, twelve from the Massachusetts Institute of Technology, five from the Georgia School of Technology, two from the Texas Agriculture and Mechanical College, seven from the University of Illinois, and five from the University of Washington. Students who are enrolled in the Air Service R. O. T. C. units at educational institutions, and who have completed two years of Air Service work are eligible for the camp if they are physically qualified to pass the medical examination to determine fitness for pilot duty.

At this advanced camp the students are taught aerial observation, and receive theoretical and practical instruction on the ground and flying experience in DH-4B planes as observers. The course of instruction lasts six weeks, and includes visual reconnaissance, radio, aerial gunnery, photography, meteorology, trap shooting, infantry drill, and calisthenics.

The administrative personnel of the camp is composed of the officers attached to the six R. O. T. C. units who have been ordered to Post Field for this temporary duty during the camp.

Air Service Reserve Unit

Enough men have been signed up in the Air Service Reserve Unit, now organized in the east bay section, to form an aeroplane squadron, photographic section and balloon company, it is announced. Those signing before the lists are finally sent in will be given an earlier consideration, and all desiring to be included in the unit have been urged to send in their names at once. Lieutenant Harvey M. Pugh, A. S. A., O. R. C., has been appointed officer, and Lieutenant James Cavagnaro, A. S. A., O. R. C., is personnel officer.

Special interest has been shown by enlisted men because of the circumstance that members of the squadron will have the status of Cadets, with a corresponding opportunity to qualify as pilots and aeroplane observers. While no definite announcement has been made, it is believed that enlisted men in the balloon company will have similar status, qualifying them for practice with observation balloons used by the Coast Defense of San Francisco.

Applications for membership in the unit are being handled by Lieutenant Pugh, care of the Western Teachers' Exchange, Berkeley, and by Lieutenant Cavagnaro, 400 Lagunitas Avenue, Oakland, Calif.

Air Service Designations

Pending the revision of Army Regulations an order issued by the Secretary of War and signed by General Pershing, Chief of Staff, states that the designation "company," as used in regulations applying to troops of Cavalry and batteries of Field Artillery, applies also to squadrons, air parks, communications sections and photo sections of the Air Service. The designation "regiment," as used in the regulations, applies also to groups of the Air Service.

Martin Bomber Wrecked

Charleston, West Virginia.—The bodies of four of five of the crew of the Army Martin bombing plane No. 5, from Langley Field, Virginia, were found Sept. 5 on the north side of Twenty Mile Creek, ten miles southwest of Summerville, Nicholas county, and the fifth member is en route by automobile to Charleston in a dying condition, according to information received by Major Davenport Johnson, in charge of the army air forces stationed here. The dead are:

Lieut. Harry L. Speck, pilot, Medford, Ore.

Lieut. W. S. Fitzpatrick, observer, Medford, Ore.

Sergeant Arthur R. Brown, Kentucky.

Private Walter B. Howard, San Francisco.

The seriously injured man is Corporal Alexander C. Hazelton, Wilmington, Del.

The plane, No. 5, with two others, Nos. 22 and 24, left the flying field here for Langley Field. They ran into a storm and No. 5 in making a bank, evidently to return to Charleston, was seen by the other machines to go into a spin and fall. Nos. 22 and 24 reported the accident and search was immediately started. The observers in Nos. 22 and 24 could give only an approximate location near Poe, which made the search difficult, but which proved to be approximately correct.

The Late Captain Louis F. Appleby

In attempting a landing at Marrs Field, Chattanooga, Tenn., Captain Louis F. Appleby, Air Service, piloting a DH-4 aeroplane, overshot the field, striking a tree and knocking the roof from a house. As the result of the crash he sustained a fractured skull and other injuries which proved fatal.

Captain Appleby, who was born in Alabama 41 years ago, was a Spanish War veteran, serving as a private with the 5th U. S. Infantry in Cuba from May, 1898, to February, 1899. He served two years in the Philippine Islands during the Filipino Insurrection, being a sergeant in the 33rd U. S. V. Infantry. He then served for a period of seven months as a Lieutenant in the Philippine Constabulary, and for several years thereafter held a position in a civilian capacity with the military establishment and later with the Civil Government in the Islands. His principal occupation in civil life was the legal profession.

During the World War he joined the second Infantry Officers' Training Camp at Leon Springs, Texas, in September, 1917. Upon graduation he was commissioned a 1st Lieutenant in the Aviation Section, Signal Reserve Corps, and placed in command of a large detachment of flying cadets at Love Field, Dallas, Texas. In February, 1918, he was placed in command of the 277th Aero Squadron which he helped to organize. He received his promotion to the grade of Captain on May 3, 1918. In the following October he was transferred to Kelly Field, Texas, for flying training, and he received his rating as Reserve Military Aviator on January 10, 1919.

In February, 1919, he was transferred to Rockwell Field, San Diego, Calif., for pursuit training, and upon the completion of the course was again assigned to Kelly Field, Texas, and placed upon border patrol duty.

Captain Appleby was discharged as an emergency officer on March 7, 1920. He subsequently took the examination for appointment in the Regular Army, and on July 1, 1920, was commissioned a Captain in the Judge Advocate General's Department. His application for transfer to the Air Service, Regular Army, was approved, and he reported to Carlstrom Field, Arcadia, Florida, for a refresher course. He was stationed at that field until May 7, 1921, when he was transferred to Corps Headquarters at Fort McPherson, Ga., where he assumed the duties of Assistant Corps Area Air Officer under Major Clagett. He returned to Carlstrom Field on August 1st for his aeroplane pilot tests, which he passed on August 3rd.

Captain Appleby's services in the Army demonstrated that he possessed the ability of an executive of the highest caliber. He was tireless in his devotion to duty and a steady, reliable officer. His death is a great loss to the Army and a source of deep regret to his brother officers and many friends.

Airmen to Attend Dinner

Aviation experts to the armament conference in Washington will be guests at the third annual dinner and reunion of American aviators at the Hotel Commodore on Armistice night, November 11.

The committee includes Laurence L. Driggs, chairman; Arthur H. Alexander, Gerald C. Brant, Edward V. Rickenbacker, Sumner Sewell, E. Garnsey Brownell, Elliott Springs and James B. Taylor, Jr.

Book Review

There has just appeared from the press of George H. Doran Company a very interesting book entitled "The German Air Force in the Great War," compiled by Major George Paul Newman and 29 fellow officers in the German air service.

This book is based on the records of the twenty-nine officers and officials of the naval and military air service and is therefore one of the most valuable documents that has thus far come out of Germany. The illustrations, thirty-five in number, show every phase of aerial activity. Valuable new material is set forth in detail and many official secrets are released for the first time. The closing chapter gives the German viewpoint on the future of the aircraft. They are not immediate competitors with the railway and automobile, but their sphere does lie far beyond the present conception. They will be of aid in high-seas fisheries for instance, they will aid the police force, be used for making maps and will of course shorten space.

FOREIGN NEWS

Dutch Service Aircraft Markings

It is notified in Admiralty Orders that the markings of Dutch military and naval aircraft have been altered by Royal decree as follows:—At the end of each wing (on the top side of the upper plane and the under side of the lower plane, and in the case of monoplanes on both sides of the plane), also on both sides of the body of the machine, the mark carried shall be a circle divided into three equal sectors, and a small concentric circle within them. The inner circle is to be orange coloured and the sectors of the outer circle are to be coloured successively red, white and blue. These marks will be carried only by Dutch military aircraft; the word "military" is here used in the sense of "non-civilian."

New Air Mail Service from Cairo to Baghdad

The new air route which was recently opened across the desert from Palestine to Mesopotamia is, it is officially notified, to play its part in the establishment of an air mail service which has been authorized between Cairo and Baghdad. This service will be operated by Royal Air Force aeroplanes, and is being undertaken as part of the training programme in the Middle East; it is to run fortnightly from August 1. For the present the service will be restricted to the conveyance of official correspondence, and all Government Departments concerned have been invited to use it. Outgoing mails will be collected at two centres—London and Cairo. Those from London will be forwarded by the G. P. O. by ordinary transport to Egypt, the bags being handed over at Port Said by the captain of the steamer to a representative of the Royal Air Force. These, together with official dispatches gathered together at Cairo, will be forwarded by air from the aerodrome at Heliopolis. The route which will be followed is:—Heliopolis-Ramleh, 260 miles; Ramleh-Amman, 65 miles; Amman-Kasar Azrak, 55 miles; Kasar Azrak-Ramadie, 400 miles; Ramadie-Baghdad, 60 miles. The total length of this line is 840 miles. On arrival at Baghdad the bags will be handed over to the postal authorities for distribution. Correspondence from Mesopotamia to England and to Egypt will be handled in a similar manner. It is estimated that a saving of 10 to 14 days will normally be effected by this service, but in the meantime only duplicates of correspondence will be forwarded.

German Civil Aviation

The extent to which the German Government is fostering civil aviation is not generally recognized, and the information given by the Secretary for Air of the British Government on this subject in Parliament will open the eyes of many people. Remarkable progress is being made, having regard to the restriction on aircraft construction imposed by the Peace Treaty. There are in Germany two main bodies which virtually control all air traffic—the Deutsche Luftreederei and the Nord Deutsche Lloyd. The latter comprises some eight or ten companies, the most important of which are the Rumpler, Albatross, Sablatnig, and Junker concerns. Large numbers of societies have been founded throughout the country with the object of stimulating interest in, and promoting the development of aviation in all its civil aspects. The government is indirectly represented on the "Flug and Haven," which is the most influential of these institutions. Although prohibited by the Allied authorities from running air services outside of Germany, a number of internal air routes are in operation, and a considerable sum has been allotted by way of Government subsidy. All the services, the majority of which are based on Berlin, are being maintained by about 100 old military machines which the operating companies have been allowed to acquire.

British Transport Records

Two air transport companies have created new records for themselves last week. The Instone Line carried no fewer than 188 passengers over the London-Paris route, and the Messageries Aeriennes carried 103 air travelers over the same route. Both of these figures are records for the firms concerned. In spite of this, however, the total of all traffic for the week was below that for the past few weeks, being only 482. This is due to a falling-off in passengers on the Amsterdam route, and to an epidemic of engine trouble on the "Goliaths."

Aerial Survey in India

Following on the announcement that a survey of the Orinoco delta is being undertaken by the Bermuda and West Atlantic Aviation Co., we see that the Survey Department of the Government of India has issued a paper which deals with some experiments in aerial surveying which have been made out there, and draws conclusions therefrom. To test the utility of the aerial camera a mosaic of the city of Agra was made, but the survey experts concluded that "nothing is to be gained by adopting the air method for normal one-inch surveys of the plains of India." This conclusion can be easily appreciated. The report goes on, however, to consider the problem of surveying large areas of densely wooded hill country, of which there are many in India and Burma, and for these the use of the aerial camera is recommended. It is sometimes important that these tracts should be accurately surveyed for mining or forestry purposes, but the expense of surveying from the ground is very high, and indeed, when minor details are needed, it is often prohibitive. The aerial survey, in fact, seems to be the only practical method.

The Survey of India report naturally dealt with broad principles and mainly from the point of view of the surveyor who wants a map. The aeronautical side of the question is also of great interest, comments Aerial Age. An officer of the Royal Air Force was employed for the experiment, and there is a danger that such a very official Government as that of India should never go further than consulting the Service men. Able as these officers are in their work, one cannot expect them to look at commercial and industrial matters from the same impartial point of view as men who have devoted themselves to the study of civil flying. In this case it is to be hoped that the Government of India does not intend to risk the lives of pilots unnecessarily by sending them in ordinary Service aeroplanes to fly over "large areas of densely wooded hill country." Such work should be reserved for special multi-engined aeroplanes which can be guaranteed immune from forced landings. Or, again, the semi-rigid airship, about the suitability of which for India we recently published an article, may prove a success out there; and if so its power to fly slowly not far above the level of the earth should make it particularly suitable for survey work. In wooded country which is not hilly, but where smooth water abounds, such as the Sandarbans (i.e., the delta of the Ganges and the Brahmaputra) and some parts of Burma, the seaplane or flying boat may prove the best craft. The Orinoco expedition will soon provide data for deciding that point.

Work of the British Air Office

Major C. C. Turner gives the following interesting data on the work of the British Air Office in the London *Observer*.

Civil flying having been the care of a separate State department only since May, 1919, a great deal of foundation work has been necessary; and the amount of official supervision has been greater in the first two years than it will have to be in any future period of the same length. The International Air Convention is not yet ratified, but so far as Great Britain is concerned most of its provisions are already being carried into effect. The amount of flying may not be considerable, but it has been necessary to lay down the same rules for it as if it were ten times as much.

The Air Ministry issues notices relating to navigation, to prohibited areas, to Customs, to wireless, to details concerning the care of machines, and so on. It follows that all who have to do with our air routes are weekly, and sometimes daily, in receipt of communications from the Air Ministry. By many of those concerned these notices have been preserved and classified for reference, and they constitute a valuable and interesting record.

The Air Ministry issues notices to airmen on green paper. In this case, by the way, "airman" means "pilot," whereas in the Royal Air Force an "airman" is one of the rank and file, who very rarely go up into the air in any capacity. Notices to airmen, which are frequently added to, or "cancelled," as the case may be, give lists of wireless stations in operation in connection with civil air routes, together with the call sign and wave lengths used by each, and the latitude and longitude; and there are similar lists for France, Belgium, Denmark, and other countries; they warn pilots of temporary obstructions; a recent one sets out the plan for the compulsory examination of pilots in meteorology; they give rules governing imports by air into France, Holland, and other countries; new signposts and lighthouses are the subject of frequent notifications; the flying of kite balloons at Howden airship station is the subject of a warning to aviators; "summer time" regulations in the various European countries are notified; the movement of a lightship in Danish waters is published; and the enlargement of the "aerial corridor" into France is notified.

The periodical issue of the "Consolidated List of Aerodromes for Civil Use" tabulates all Government-owned aerodromes containing accommodation, all emergency aerodromes, all licensed civil aerodromes, and all unlicensed private aerodromes. These show the nearest railway station, the height above sea-level, and other particulars. One notice gives the cloud, visibility, and weather signals displayed at Lymphe for the information of passing airmen; a simple code enables him to see ahead the conditions he will have to fly through.

Yellow papers are those containing notices to ground engineers, and they concern such details as the tightening of bracing wires, the disuse of high-compression pistons on a particular type of engine, a warning as to the discovery of a weakness in the valve rocker of a certain type of engine, a warning that certain control cables should be replaced by a stronger kind, a caution that the rubber connections in petrol systems must be frequently examined, and many other technical details only understood by the expert.

In addition, the Air Ministry issue periodically a "Resumé of Commercial Information," consisting of extracts from the foreign Press, together with much information obtained by the Ministry from other sources that is likely to be serviceable to British firms. It also issues the lists of new pilots' licenses, statistics of flying and the passengers and goods conveyed by air, the customary half-yearly reports (with the Air Ministry's own summary for newspaper purposes), and, of late, much Press matter relating to airships and the report of a lecture by the Controller-General of Civil Aviation to the Institution of Civil Engineers.

A valuable series of technical memoranda containing the results of the latest researches are published, and are on sale in the usual way. And occasionally there is a little blue-covered book, for example, one dealing with the compulsory examination in aerial navigation of all pilots, which, however, one gathers is not yet strictly compulsory.

Stockholm-Reval Service

On the 19th of August, the air service between Stockholm and Reval was begun, with Italian seaplanes, Savonia type S16. Pilot Longo, with mechanic Pescatori made their first trip in three hours time carrying on board three passengers and the mail load. The line, which is run by the Svenska Lufttrafik company, will soon be extended as far as Helsingfors.

A Maharaja Helps Forward Aviation

At Allahabad the Maharaja of Bharatpur has, according to the *Daily Telegraph* correspondent, opened an aviation academy with a fully qualified aeronautical staff. The academy proposes to deal with every branch of aviation, including flying instruction, instruction of ground staff, the sale and erection of aeroplanes, and passenger flying. His Highness has fitted out a large aerodrome occupying over 1,500 square yards, which has a good surface throughout. Would-be owner-pilots will have the use also of the splendidly equipped Bharatpur workshops.

New Hanriot Coming Along

The French Hanriot works are completing a new machine in which metal construction has been extensively used. The machine is said to be intended for colonial use, and can be used to carry six passengers. If used for military operations the machine will carry the equivalent weight in bombs. As an air ambulance the machine can be adapted to carry, in addition to the pilot, two stretcher cases and an attendant.

The Coupe Michelin

French pilots have been working hard in connection with the Michelin Cup during the last week or so. The contest is for a circuit of France (3,000 kiloms.—1,860 miles), and was last won (in 1914) by Eugene Gilbert on a Morane-Saulnier monoplane. This year Bossoutrot competed on a Farman Bajac on a Spad and Poiree (of Monaco fame) on a Caudron. Bossoutrot had to give up, and the race rested between Bajac and Poiree. Just as we are going to press it is learned that the competition was won by Poiree on the Caudron, whose time for the trip was 37¼ hours.

ELEMENTARY AERONAUTICS and MODEL NOTES

CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

CAPITOL MODEL AERO CLUB
1210-18th St., N. W., Washington, D. C.

AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Historical Review of the Capitol Model Aero Club

The Capitol Model Aero Club, Washington, D. C., organized in 1915, has prospered every year since, although at some times more actively than others. The total number of models made by members approximates sixty, and the members enrolled since incorporation number over fifty. Model meets at various times have demonstrated the efficiency of the members' efforts, and by window displays, etc., local interest has been kept aroused in aviation. Aside from the actual model making, the endeavor has always been to teach and maintain an interest in senior areonautics; this has resulted in furnishing three pilots to the American Air Forces, and one to the Air Mail Service, beside several "Ground Aces", as they call mechanics and such.

At present most of the members are away on vacations and business, but with the early fall, the Club is to open for the season, and an unusually large membership is expected, together with more than usual enthusiasm. The plan of procedure will be similar to that of former years, namely, of promoting a member thru successive grades as he shows aptitude and knowledge, and thus encouraging study and manual effort. The different steps are rewarded by suitable insignia for which the members diligently strive. The meetings are accompanied by lecture upon an interesting phase of the work, beside the regular business, and various contests are held to determine the most active members.

In Mr. Garber's work with the boys, he is most ably assisted by his two major officers, Mr. Burt, and Mr. Irelan, both excellent artisans in model aeroplanes, and ardent enthusiasts of aerial transportation, of whom future aeronautics may well expect a great deal, if they keep up their present efficiency.

To the devotee of model making, the Club extends its hand in comradeship, and assures any one taking up the science, an occupation which will deliver more true fun and genuine knowledge than any other, and gives its own experience as proof.

The Club will keep AERIAL AGE readers informed of its movements and asks for correspondence from other clubs.

Their address has changed from 1726 M street, N. W., to 1210 18th street, N. W., and all communications should be addressed to the president of the Club, Mr. Paul Edw. Garber, who is the Aeronautical Modelmaker of the U. S. National Museum, Smithsonian Institution, Division of Mechanical Technology.

Notes of the Illinois Model Aero Club

The first hand-launched duration meet of the Illinois Model Aero Club brought out several record breaking models. The model made by Mr. Pond flew 2,465 feet, breaking the world's record. This model weighed only one and one-half ounces. Another machine, built by Mr. Warren De Lancey, a forty-eight inch hollow spar twin pusher, made over 3,000 feet, a dozen times or more.

The former official world's record twin pusher hydro duration of 118 seconds (held by Bruno Likosiak) has been officially broken by Mr. Bertram Pond, who made 172 seconds by the I. M. A. C. first meet of the year at Lake Calumet, Chicago, Ill. The three official flights in the contest averaged nineteen seconds more than the old record, proving that the latest record was not made by a freak flight or by a lucky chance.

Below is a schedule of I. M. A. C. events from August to December, 1921:

1. Aug. 19. Business meeting. Talks on general design.
2. Aug. 21. Hand launched duration meet at Ashburn Flying Field.
3. Sept. 2. Business meeting. Construction of models demonstrated.
4. Sept. 5. Annual speed and looping contest. 300 foot course for speed.
5. Sept. 16. Business meeting and model talks.
6. Sept. 25. Hand launched distance meet, and picnic at Ashburn Flying Field.
7. Oct. 7. Business meeting and model demonstrations.
8. Oct. 21. Business meeting and talks by pilots.
9. Nov. 4. Business meeting.
10. Tuesday, Nov. 15. Tenth annual Illinois Model Aero Club banquet.
11. Nov. 18. Business meeting. R. Jaros authority on scale models will speak.
12. Dec. 2. Business meeting and annual scale model contest.

All business meetings are held in Room 132, Auditorium Hotel at 8. p. m.

To reach Ashburn Flying Field, take Wabash suburban train to Ashburn station and walk 4 blocks west.

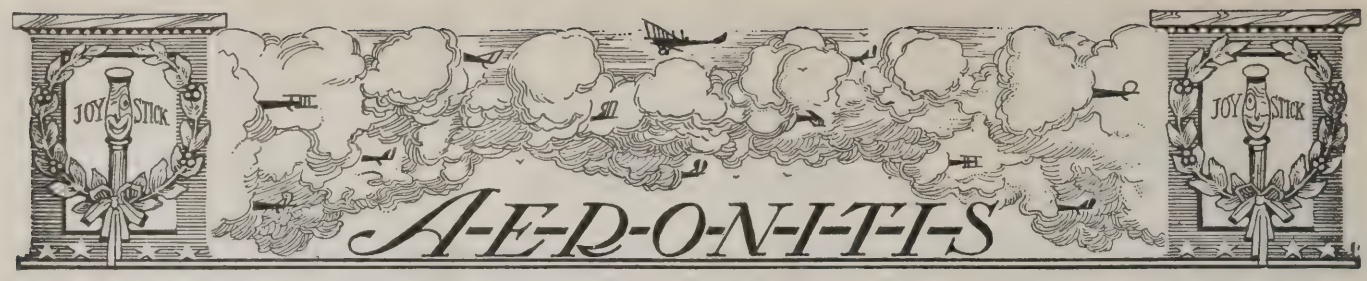
Model Builders Employ Standard Wing Sections

An ever increasing tendency is shown by model builders toward the adoption of tested wing sections in general use for carefully built scale and flying models. In the earlier days of model building, flat wings and thin wing sections constructed with a view to ease of construction, resulted in very slow progress in distance and duration flights.

Referring to records made several years ago, we find few records of record flights made, except by builders who became skillful as designers of light, efficient wing curves. At the present time it is observable that more builders than ever avail themselves of the information given out by the government on the subject of the lifting properties of various wings tested. Model builders realize the great advantages that are possessed by those who have an extensive knowledge of wing-curve characteristics. By testing out some of these curves on the ordinary "A" type rubber driven models, it is possible to become thoroughly acquainted with the contours of approved standard wing curves, and even some of their aerodynamical properties can be witnessed during flight. Model builders will appreciate, however, the differences that exist between the behavior of a wing-curve during flight, the angle of incidence of which can be altered (as in a full-sized aeroplane), and the performance of a curve held rigidly to one incidence angle, as necessary in a model. Sufficient information to make the subject interesting is to be had by putting to some immediate practical use this valuable information which is not so easily understood or remembered by a casual reference to it.



Members of the Illinois Model Aero Club. On the ground at the right can be seen Mr. Pond's tractor which flew 2465 feet. Above it is Mr. Schweitzer's 4029 foot record holder. Two of the other models shown have flown over 175 seconds duration



"My First Solo"

I climbed up in the machine,
To make ready for a flight.
OH, what a feeling,
Up and up I rose with the J. N.
For the O. X. was humming merrily.

I looked down to see the world rush by,
On and on I sped.
OH, what I feeling I had.
I nosed her over to make for a landing,
No landing place could I see.

Near and nearer I glided to earth,
With the machine out of control.
OH, what a feeling I had
Heading straight for a tree,
For when I awoke, I found myself under an OAK.

Standing near was a little boy,
He said to me.
"Honest, mister, I only shot at a sparrow."
OH, WHAT A FEELING I HAD. —*"Rupe."*

Our Memory's Good, the Joke's Old

Patient: "I wish to consult you with regard to my utter loss of memory."

Doctor: "Ah, yes! Why—er—in cases of this nature, I always receive my fee in advance."—*Science and Invention.*

Yeah

Prof.: "Would you call the last decade of trouble in Mexico a civil war?"

Stude: "Wadda you mean 'civil'?"—*Missouri Showme.*

Sweet Hopefulness

"That's a bad cold you've got, old man. Are you doing anything for it?"

"Not yet. I'm in hopes that it will get bad enough to be good for a prescription."—*Judge.*

Wouldn't Last Long

A tourist in Scotland came upon a farm in a remote highland glen.

"How delightful to live in this solitary spot," he remarked to the farmer.

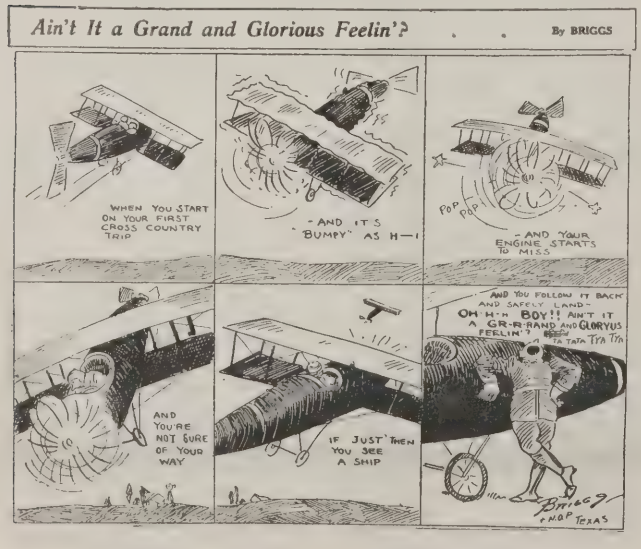
"I'm no sae shair about that, sir," replied the farmer. "Hoo wad ye like to hae to gang fifteen miles for a glass of whusky?"

"Oh," said the tourist, "but you could keep a bottle."

The farmer shook his head.

"Ah, mon," he said seriously, "whusky'll no keep."

—*Pittsburgh Chronicle-Telegraph.*



Embarrassed

I longed to tell her, and yet my tongue clove to the roof of my mouth; would she understand, I wondered? I had known her but a scant month, and yet I felt as though I had known her for months, aye, for years, and yet . . . How can one tell a woman that she has forgotten to rouge both sides of her face?—*California Pelican.*

Had to Be Shown

"Noo, tell me," said the Scoth customer, "is this hair restorer certain tae mak hair on a bald heid?"

"Yes, sir," said the druggist. "It will accomplish it in twenty-four hours."

"Weel," remarked the other, "that's nae lang tae wait. Just rub a lettle on yer ain bald place and I'll come in in the morning an' see if yer spekin' the truth."

—*Pittsburgh Chronicle-Telegraph.*

It was down at Langley Field
That their rep was firmly made;
When the battleships had to yield
To the boys of the 1st Brigade.

Days and weeks and months they worked
With bombs and sights and racks;
No mission, trip or job was shirked,
They were right there with their hacks.

U-boats, cruisers and dreadnoughts too,
The best that rode the waves,
Were sent to rest by an aerial crew,
And they rest in watery graves.

Far out o'er the sea or way up high,
Far away from old mother earth,
Carrying bombs thru' the stormy sky,
The brigade has proven its worth.

In future days new wars will be fought,
And new history will always be made,
But never will a better lesson be taught,
Than the one taught by the 1st Air Brigade.

—*Hargemac.*

A young man came out to the field,
To inspect the aeroplanes, with me at his heels.
After the inspection he made up his mind,
To take a spin in a canuck, and he will find,
The fuselage out of line. —*"Rupe."*

"Aeroplane Talk"

A roar, a buzz, an aeroplane appeared in the western sky,
It came down to make a landing from way up high,
The pilot climbed out, his name I believe was Sims,
From New York to Chicago to deliver moving picture films.

Filled with oil and gas he took off,
To go up aloft,
A roar, a buzz growing fainter and fainter, till it was a dot,
For the afternoon was sultry and hot.

—*"Rupe."*

Some Live Wire

Officer: "Why didn't you send that electrician to fix my door bell?"

Sparks: "He did go, sir, and as he rang the bell three times and got no answer, he concluded that there was nobody home."

—*Great Lakes Bulletin.*

Cluck, Cluck!

Poet: "Did you receive my poem, 'The Patient Hen?' "

Editor: "Yes, it's laying in the waste basket."—*Judge.*

Like the Dodo

"Yes," remarked the highbrow caller, "I rather pride myself on the discovery of another hypothesis."

"Indeed!" returned Mrs. Newrich, a little doubtfully. "I had an idea they were quite extinct."—*Boston Transcript.*

AERIAL AGE WEEKLY

UNIVERSITY OF ... SEP 2 ...

L. 14, No. 3 SEPTEMBER 26, 1921 10 CENTS A COPY



State Capitol at Topeka, Kansas. Photographed from a Longren Aeroplane

Does Engineering in Aeroplane Design Pay?

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



BUY IT FROM ★ ★ THE NAVY



·Boeing Sea-Plane·

The *Boeing Sea-Plane* is a tractor biplane, equipped with a *Hall-Scott 100-horsepower engine*. It is a two-float type with two places and dual control wheels. The draft when fully loaded is fourteen inches. The wing spread is about 44 feet and the supporting surface, including ailerons is 495 square feet. The weight light, including instruments and water is 1,940 pounds and the total weight is 2,450 pounds, which gives 5 pounds per square foot and 24.6 pounds per horsepower

The maximum and landing speeds are 73 and 46 miles per hour respectively, the climb is 2,500 feet in ten minutes and the endurance is 2.2 hours.

The *Boeing Sea-Plane* is manufactured by the Boeing Airplane Company, Seattle, Wash.

The planes are located at the Naval Air Station, San Diego, Calif.

They are new and unused and have not been removed from the original packing crates.

Cost (approximately) $10,300.00. Sale price $1,500.00.
Handling trucks for Boeing Planes $ 100.00.

Curtiss "OX" and "OXX" Curtiss "V-2" 200 HP Sturtevant 140 HP. U.S.A-12 Liberty Hall-Scott A-7-A Hall-Scott A-5-A. Wisconsin, Renault, Gnome, Fiat. . . . . .

Radiators, Tachometers, Altimeters, Thermometers, Aero Watches, Clocks, Compasses, Barographs, Cameras, Propellors, Spark Plugs . . . . . .

Write for Illustrated and Descriptive Catalog **Today**

CENTRAL SALES OFFICE
Bureau of Supplies and Accounts
NAVY DEPARTMENT, WASHINGTON, D. C.
Sales Room Bldg., 176 Navy Yard
Washington, D. C.

September 26, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 3

TABLE OF CONTENTS

Does Engineering in Aeroplane Design Pay? 51
The Aeroplane Speaks 51
The Versatile Aeroplane 51
A Bureau of Commercial Aeronautics 52
The News of the Week 52
The Aircraft Trade Review 54
The New Longren Biplane 55
A Money Saving Ford Accessory 56
Electro-Magnetic Brakes for Aeroplanes 57
A New Method of Testing Models in Wind Tunnels 58
United States Post Office Department Air Mail Service 62
Naval and Military Aeronautics 63
Foreign News 64
Elementary Aeronautics and Model Notes 65
Aeronitis 66

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

AIR PLANES — WICHITA, KANSAS

The Laird Swallow
"America's First Commercial Airplane"

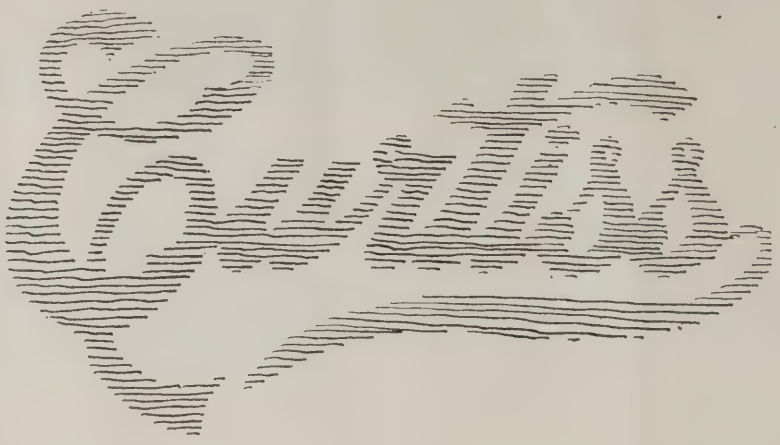
NOW $4,500 F. O. B. WICHITA, KAN.

INCREASED production enables us to announce this reduction, effective immediately. At this price the Laird Swallow will be the most wonderful buy in America today. Brand new in every detail—built in our own factory, powered with the OX5 motor, carrying three passengers with full load of fuel and baggage—magnificent in performance—remarkably low upkeep and operation costs.

Our new sales plan will be most interesting to every person interested in aviation. Write for details and booklet.

E. M. LAIRD COMPANY
Manufacturers
WICHITA, KANSAS
General Sales Offices
2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.,
2216 So. Michigan Ave., Chicago, Ill.
Please send me details of your new sales plan and copy of booklet.
Name .....
Address .....
.....
AA



A Further Reduction

APPROXIMATING 25%

in the price lists of parts

for

Orioles
O X Standards

Jennies
C 6 Standards

is announced

EFFECTIVE SEPTEMBER FIRST

Write for revised price lists.

Motor price lists are not affected in this reduction.

CURTISS
AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLOUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., September 26, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, SEPTEMBER 26, 1921 NO. 3

Does Engineering in Aeroplane Design Pay?

IN last week's editorial column the need was discussed for more and better engineering in order to secure greater safety in aeroplane operation. It was shown that from this viewpoint to economize on engineering was a most expensive and hazardous business.

But there is another side to this question. Assume that an aeroplane is strong enough, is protected from the danger of fire, and is stable. Suppose no accident ever occurs to it. Does it follow that such an aeroplane would be commercially successful where such success is possible with proper equipment? Not at all. Three other requirements must be met by the real commercial aeroplane. These are high ratio of paying load to gross weight, good performance as regards speed and rate of climb, and ease of maintenance. The extent to which these requirements are met is directly proportional to the quality of the engineering invested in the design and is the measure of the success of the aeroplane commercially.

Not until aviation was put upon a highly competitive commercial basis did the difference between a mediocre design and the creation of a master become so glaringly apparent. It is necessary to realize that each unnecessary pound of weight in the structure and power plant is a pound lost from the paying load. When one considers that the portion of the disposable load, aside from the pilot, fuel and oil, is only 25 to 30 per cent of the gross weight of an aeroplane, the saving of 10 per cent in the weight empty increases the earning power of the aeroplane 20 to 25 per cent.

Good engineering by improving the cleanness or "fineness" of a design makes possible either an increase in paying load at least equal to 20 to 30 per cent, based on an average good design, or a large decrease in the size of the power plant with a corresponding reduction in operating expense, to say nothing of first cost. The JL-6 was one of the first notable examples of the tremendous increase in efficiency through proper design. A later and even more striking example of what can be accomplished in this direction is Fokker's latest passenger aeroplane carrying 1000 pounds of paying load in addition to the pilot and five hours' fuel. Compare this with the performance of the DH-4 mail planes which, with a 400 horsepower engine, have a maximum mail load of 700 to 800 lbs., and only 2.5 to 3 hours' fuel. In the one case we have over four pounds per horsepower and in the other less than two. What is the inference to be drawn? Does 100 to 150 per cent increase in efficiency justify the expense of securing the services of the finest talent to be had?

Few people who are not actively connected with aeroplane maintenance problems realize the differences in maintenance costs between aeroplanes. From the viewpoint of a commercial company a design in which ease of maintenance has not been considered is a double expense. There is first the direct cost of rigging, repairing and general upkeep, and second, the loss of revenue for each day the aeroplane is laid up for repairs. One type of aeroplane may be in the overhaul department 50 per cent of the time, another 10 per cent. In these days of narrow margins of profit what chance has the first aeroplane to be anything but a white elephant? What makes the difference between the two designs? Nothing but the knowledge, thought and experience of a trained engineer.

And still one sometimes hears it said that a commercial firm cannot afford to secure the services of such a man.

B. C. B.

The Aeroplane Speaks

THE aeroplane spoke a fateful word or two at Hampton Roads last June and July, and if indications are realized it will shout out loudly when the old Alabama is bombed by air service machines this Fall.

General Mitchell is to be congratulated on the courageous report which he has placed in the hands of his chief, General Menoher, and it is to be hoped that army usage and etiquette will not stand in the way of the report getting the impartial consideration which it merits. The Assistant Chief of the air service got his knowledge of what can be done with aeroplanes at the working end of the "joy-stick," and that stacks up pretty strongly against purely theoretical deductions.

The Versatile Aeroplane

UNDER the above heading the *Dayton Journal* of August 6th makes the following editorial comment on the many varied uses in which the aeroplane is employed at the present time.

The aeroplane had first to prove its possibility. Then it had to prove its practicability. Now it is demonstrating its versatility. With this established the aeroplane, just as its predecessor, the automobile, can settle down to the quiet task of meeting man's needs.

We have small, fleet aeroplanes today that travel faster than any other contrivance man has fashioned. We have larger, more cumbersome planes that carry great loads successfully for long distances. We have planes that operate

over land or sea at will and with ease; planes, too, that can and in the sea even when the water is rough. We have planes that ascend to terrific heights in search of scientific data, and planes that engage in something as prosaic as the spreading of arsenate of lead over catalpa trees suffering ravages of insects.

Think of the versatility of the planes today—man's new toy is but partly understood and barely developed! Aeroplanes serve to deliver important mail to ships far at sea, the planes reaching the ship in a few hours from the same port the ships sailed many hours before. Aeroplanes are used to cut tedious hours from the delivery time of trans-continental mail. Aeroplanes are used by a rancher to speed him in a few hours over all his vast acres, giving him information it formerly took many cowboys days to gather for him.

Recently, when engineers were undecided as to which of three routes would be best for the construction of a railroad through certain mountains, aeroplanes took the engineers over the three routes in a few hours and showed them beyond question which was the most practical, whereas old-fashioned surveys would have taken months and cost thousands of dollars. Aeroplanes have been used in rushing persons critically ill to specialists or special hospitals many miles away. Aeroplanes are the surest, strongest weapon of national defense, as witness the recent bombing tests over the Virginia Capes, and the theoretical bombing of Washington, New York and Philadelphia.

New uses to which aeroplanes may be put are being found each day. Who dreamed, in 1899 or even in 1904, of the uses to which the automobile would be put? Who dreamed in 1909 or even in 1914, at the outbreak of the world war of the uses to which the aeroplane would be put in 1921? Who can place any limitations on the possibilities of the aeroplane 10 years from now? The aeroplane is in its first stages of development and its versatility is only now beginning to be appreciated. Ten years from now what may we not see!

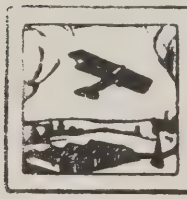
A Bureau of Commercial Aeronautics

CONGRESS seems prepared to act at last upon the matter of air traffic. Senator Wadsworth recently introduced a bill "to create a bureau of civil aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes."

There is something in these words suggestive of colonial charters to far islands and unexplored continents. Perhaps the suggestion is just. The air is a great empire in the process of charting, and Mr. Hoover, like President Jefferson at the time of the Louisiana purchase, is taking over something bigger than he can imagine. It is time, of course, that he or some government official was directed to institute the supervision of civil flying. Twelve hundred aeroplanes operated commercially last year, says the Manufacturers' Aircraft Association, flying over 3,250,000 miles. Unfortunately they made a return of forty serious accidents, resulting in fourteen deaths. Most of the accidents seem traceable to a lack of regulation—to unfit 'planes, poor landing fields, foolish "stunts," lack of meteorological information, etc. Senator Wadsworth's bill meets this situation. It provides for a bureau and commission of civil aeronautics. The bureau will examine and license pilots, inspect aircraft, make air traffic rules, assist in developing landing fields, stations, weather flying reports, etc. It will fix fees and keep records. The commissioner or his deputies can subpoena witnesses, send for documents and papers, administer oaths, take testimony, etc., in all cases affecting the granting or revocation of licenses. The commissioner is ordered by the bill to make an annual report upon his work, to be included in that of the Secretary of Commerce. Provision is made that "the district courts of the United States shall have exclusive jurisdiction over all claims and controversies involving aircraft, airdromes, and air stations, their owners, lessees, charterers, and operators licensed thereunder." The procedure "shall conform as nearly as may to the principles of law and procedure applied in cases of admiralty jurisdiction."

If Congress passes this bill it will have taken the first step toward a thriving American air industry. Flying has obviously needed regulation. The proposed bureau of civil aeronautics provides it. Under such a body useless waste of life will be avoided. Competent inspectors will weed out unsafe 'planes and forbid the air to incapable pilots. Air traffic will be controlled. With the consequent reduction of risk public confidence in flying will grow. At the same time the government —if the words of the bill get a financial backing—can undertake certain positive and encouraging work calculated to stimulate the right kind of aerial activity.

Probably Senator Wadsworth's bill will pass. We have had a number of lessons as to air accidents. Our bombing experiments produced a new respect for aircraft in Congress and, it is understood, in the cabinet. The government perceives at last, apparently, that the activity which American genius made practicable is assuming too important a place to permit it being ignored or neglected longer.—*Editorial in N. Y. Globe.*



THE NEWS OF THE WEEK



General Menoher Resigns Air Service Post

Major-General Charles T. Menoher resigned September 16 as chief of the United States Army Air Service, bringing to a climax a long-standing row in which he and his assistant, Brig.-Gen. William Mitchell, have been the central figures.

Gen. Menoher's resignation took the form of a request to be transferred to command troops in the field. There is every reason to believe the request will be granted by the Secretary of War, who then will be called upon to appoint a successor.

This will open one of the most bitter questions in the military establishment, whether there is to be an independent air service. This issue was the underlying cause of the differences between Gen. Menoher and Gen. Mitchell, but the trouble between the two, which at one time prompted the chief to ask that his assistant be relieved, will fade into insignificance when compared with the fight that is brewing.

Gen. Mitchell of course will be a candidate for chief of the service, with the support of virtually all the officers in the flying establishment, together with much outside influence, such as that in Congress. Against this will be arrayed the strength of those army officers, mostly those of high rank, backed by a strong navy sentiment, who want the air service to remain as an auxiliary arm in the fighting organization.

Just how soon this fight is likely to come to a close Secretary Weeks did not reveal. He said Gen. Menoher's request for transfer is receiving consideration. Gen. Menoher himself has not been advised what to expect, but he is confident his wishes will be fulfilled. It is possible the whole matter will rest until the return to the United States of Gen. Pershing, Chief of Staff of the Army, who is on his way to France and is not expected home much before November 1.

It may be said authoritatively that Gen. Menoher's decision to retire as chief of the air service did not come as a result of any specific incident in the long-continued clash with Gen. Mitchell, but rather in consequence of the whole. Specific denial has been made that Gen. Mitchell's recent reports on the bombing tests held in June and July off the Virginia Capes had anything to do with the action. These reports have not been made public, but it is understood sharp issue is taken by Gen. Mitchell with the conclusions of the joint board headed by Gen. Pershing and composed of officers of the army and navy, whose report, while crediting aircraft as a powerful factor in modern warfare, held that the battleship cannot be regarded as obsolete and an easy prey to aerial bombs.

Gen. Mitchell's contention has been that any warship afloat could be sunk with bombs. His declarations have antagonized the navy for months, officers of this service having been outspoken in their statements that Gen. Mitchell was trying to bolster up the air service by unfairly discrediting battleships.

The thing Gen. Mitchell really has been striving for, of course, has been the establishment of the air service as an independent branch of the military organization on a par with the army and the navy. He would consolidate under one Cabinet officer the flying services of the army, the navy and the Marine Corps, building up a tremendous air fleet for use over both land and water.

Gen. Menoher has been opposed to this, having the support also of most of

the officers of the General Staff, including Gen. Pershing. He wants the army air service continued as an auxiliary for scouting purposes and attack, an army unit such as the cavalry, the infantry and artillery. Just as these dominant army officers want the air service kept in the army, the navy establishment wants to keep its own flying corps.

Much will depend on the recommendations to Congress that will be made soon by the joint Congressional Committee on Reorganization of Government Departments. The programme now being worked out by that committee provides for the consolidation of the War and Navy Departments under the title of the Department of National Defence, in which the air services are to receive special recognition, perhaps be consolidated.

Funeral Services for ZR-2 Victims

Funeral services were held September 17 at the New York Navy Yard, Brooklyn, for the fifteen Americans who lost their lives in the explosion of the dirigible ZR-2.

The services were attended by the diplomatic representatives of Great Britain, France and Brazil, Secretary of the Navy Denby with several American naval officers of high rank and several hundred relatives and friends of the dead with their invited guests. The ceremony itself was confined to the reading of the burial service of the Episcopal and Roman Catholic churches, the singing of two hymns and the placing of wreaths on the coffins.

Although preparations had been made for the handling of a crowd of 25,000, fewer than 500 attended, many persons being kept away by the rain, which fell throughout the services. The small number who attended, together with the incessant drizzle, prevented the funeral from being so impressive as it otherwise would have been.

When the bodies arrived on the British light cruiser Dauntless they were carried ashore and placed in building 16 at the navy yard. It was originally planned to hold an oper air funeral service on the athletic field, but the rain caused a change in plans.

The ceremony began at 2:30 o'clock. The coffins, draped with flags and flowers, were faced by chairs for naval officers and invited guests. The first four rows were reserved for friends and relatives of the dead. Behind the coffins, against a wall draped with American flags, were chairs for the chaplains and a few guests. Double columns of American, British, French and Brazilian marines faced each other along the two side walls.

Lieutenant Commander F. E. Moyer, Episcopal chaplain, read the Episcopal funeral service and ended with a short eulogy in which he said that the men had lost their lives because of "the love that is the bugle call that leads us to a higher civilization."

Then the New York police quartet sang "Lead, Kindly Light," and Secretary Denby stepped forward, and in behalf of President Harding and the Navy Department placed a wreath on each of the fifteen caskets. He was followed by representatives of the British Embassy.

Chaplain Matthew C. Gleason, Catholic chaplain, then read the Roman Catholic burial service, and the police quartet sang "Nearer My God, to Thee." Three volleys were fired by marines outside, the bugler sounded taps and the mourners filed out of the hall.

Oswald C. Hering, in behalf of the D. K. E. Fraternity, as its president, laid on the casket containing the body of Commander Louis H. Maxfield a large wreath in the fraternity colors of red, gold and blue. Commander Maxfield joined the fraternity while a student at the Massachusetts Institute of Technology.

With Secretary Denby were Capt. D. F. Sellers of the navy and Col. D. D. Porter of the Marine Corps. Others who attended were Rear Admiral W. A. Moffatt, Rear Admiral Hilary P. Jones, Gen. Robert Lee Bullard, Commander Kenneth Whiting and Lieut.-Commander Zachary Whiting.

Sir Hugh M. Trencherd, British Air Minister, also was present. He was accompanied by Capt. Gloucester Armstrong, British Consul-General; Capt. Stephenson of the cruiser Dauntless and other representatives of the British Government.

After the services the bodies were taken to the navy yard hospital to be prepared for burial. The body of Lieut. Emory C. Coll will be buried at sea in response to a desire which he expressed a short time before the ZR-2 disaster. Three bodies, those of Commander Louis H. Maxfield, Lieut.-Commander Valentine N. Bieg and Chief Machinist's Mate George Welsh will be buried at the Arlington National Cemetery.

Annual Aviators Dinner

The annual aviators' dinner this year will be held as usual on Armistice Night, November 11, 1921, at 7 P. M. in the Commodore Hotel, New York City. A large invitation committee has been formed consisting of one member of each overseas squadron in the Army, the Navy and the Balloon Air Service, together with a delegate from each one of the Flying Fields at home and abroad. These Committeemen have undertaken to get into touch with every member of their old war-squadrons and to secure a full attendance at this year's dinner.

Pilots change their addresses with such frequency that the Dinner Committee has found many of the invitations returned each year by the Postoffice. This is the great aviators' reunion of the year, and it is hoped that every airman who sees this announcement, whether or not he has received his invitation, will communicate with the Armistice Dinner Committee, No. 52 Vanderbilt Avenue, New York City and reserve his seat at the Armistice Reunion Dinner.

Uniforms will be worn and squadrons will be seated together at their own tables. There will be no speakers' table, and no speeches. A number of former enemy aviators, now in New York, have been invited to attend the dinner this year as guests of the Committee.

Steps will be taken to effect a permanent organization of the Veterans of the War-in-the-Air—at this year's dinner. There are nearly 3,000 Aviators living in or near New York, and practically every large city in the country has its local Flying Club, composed mainly of war aviators. It would be an unquestionable advantage to American Aviators to have this great fraternity bound together into one closely united National Association.

The Committee in charge of the dinner is: Lawrence L. Driggs, Chairman, Arthur Hadden Alexander, Gerald Clark Brant, E. Garnsey Brownell, Eddie V. Rickenbacker, Sumner Sewell, Eilliot W. Springs, James B. Taylor, Jr.

Bombing of the Alabama

Just as we go to press it is announced that the Army Air Service has set September 21 as the tentative date for the start of the bombing experiments with the obsolete battleship Alabama. The tests, which are to be even more spectacular than those held off the Virginia Capes recently with one-time German warships as targets, will occupy four or five days.

One of the features of the attack will be night bombing, when aeroplanes with the aid of flares will send missiles from the sky on the battleship. It will be the first time such a thing has been done in America. Gas bombs also will be used.

The battleship Alabama was turned over to the army by the navy for the experiments which will be held in Chesapeake Bay, near Tangier Island, off the Virginia coast.



Virginia Varney, daughter of Walter T. Varney, who flew from San Francisco to Yosemite in a San Francisco Call aeroplane. Also pictured are Mrs. Walter Varney, her mother, and Chief Ranger Townsley

The AIRCRAFT TRADE REVIEW

Experts Urge Navy to Buy a Zeppelin

Washington—Procurement of a dirigible of the Zeppelin type—from Germany, if possible—to replace the lost ZR-2 and continuation of construction of the ZR-1, now building at Lakehurst, N. J., were recommended September 17 to President Harding and Secretaries Denby and Weeks by the National Advisory Committee for Aeronautics.

Continued production of helium, the new gas used for inflating airships, also was recommended by the committee, which is composed of army and navy officers: Charles F. Marvin, Chief of the Weather Bureau; Orville Wright and Dr. Charles D. Walcott, Secretary of the Smithsonian Institute, who is chairman.

The committee's recommendations were drawn up at a meeting on September 15, at which the destruction of the ZR-2 in its relation to the future of airships in the American naval and military establishment was discussed. After this discussion the committee formulated its recommendations as follows:

Whereas, Rigid airships have been primarily developed in Germany as a result of persistent efforts which could not be dampened by failures comparable to the recent destruction of the English-built ZR-2, and the practical application of such airships to useful purposes of war and of peace has been exemplified by the Germans:

And Whereas, the English have prosecuted the development of rigid airships with considerable success, patterning after German designs;

And Whereas, An official investigation is being made in England of the ZR-2 disaster which may determine the proximate cause of the accident itself, the conclusion is certain that whatever was the primary cause of the accident, the use of hydrogen was a contributing cause to the great loss of life.

And Whereas, America possesses the only large store of helium which is known to exist, by the use of which airships can be more successfully developed by America than by any other country for commercial as well as military purposes;

And Whereas, the present program of the United States in regard to the construction of rigid airships can be regarded only as extremely conservative;

And Whereas, It would be contrary to the true American spirit to abandon a conservative program because of one serious accident, when it is possible, by studying the cause of the accident, to profit by any mistakes that were made;

Therefore Be It Resolved, That the National Advisory Committee for Aeronautics is of the opinion that the development of rigid airships should be continued in this country; that sufficient funds should be devoted to experimental work for the obtaining of definite information regarding the strength qualities of materials and girders used in the construction of airships, and for the development and checking of the theories used in the general design of airships; and that the present program for the construction of the airship ZR-1 and for the production of helium should be prosecuted with renewed vigor;

Resolved Further, That the National Advisory Committee for Aeronautics believes it advisable that the Government of the United States should secure a recent type of German rigid airship, preferably directly from Germany, to fill the vacancy in the program caused by the loss of the ZR-2.

Balloons Start in Gordon Bennett Race

Brussels — Under intermittent showers and strong easterly winds the fourteen contestants in the balloon race for the James Gordon Bennett Trophy started on the afternoon of September 18.

The big gas bags went away at intervals of ten minutes. The English balloon Banshee, piloted by the English aeronaut Baldwin, was sent off at 4:20 P. M. with the wind blowing between thirty and forty miles an hour. The strong wind gave the pilots considerable trouble, and Uselli, the Italian entrant, withdrew owing to damages to his balloon.

Ralph Upson, American, in a balloon lent to him by Lieutenant de Muyster, a Belgian aeronaut, was the third to get away and disappeared in a south-westerly direction. Lieutenant de Muyster's balloon was the Belgica I., with which he won the race from Birmingham, Ala., in 1920, flying to Vermont.

Bernard van Hoffman, flying the City of St. Louis, got away at 4:05 P. M. and Wade T. van Ormand, in the City of Akron, at 4:30 P. M.

The balloon of the French aeronaut, M. Biernaime, was damaged, but he was able to start.

When the Belgian entrant, Belgica, started, a soldier became entangled in the ropes. He was unable to extricate himself and was carried aloft as the gas bag ascended. The spectators below watched the soldier hanging to the rope, swaying in the wind, as Lieutenant De Muyster and his companion in the basket slowly hauled him to safety just as the balloon disappeared among the clouds.

Aeronautic experts say that the extra passenger in De Muyster's car will prove a handicap to him in the race, as it probably will be necessary for him to throw over his ballast before his opponents are required to do so.

Owing to the direction of the wind the aeronauts are likely to be carried over the English Channel or the Atlantic Ocean. Some of the experts think there is a possibility of the contestants landing either on the Cornwall, England, or Brittany coasts, and some are of the opinion that the gas bags may be driven as far north as Ireland.

May Replace the ZR-2

LONDON—Reports that the American and British Governments may arrange for the transfer of one of Great Britain's remaining airships to American ownership, to replace the wrecked ZR-2, have received some credence in American official circles here, where it is stated that the American Government, some time before it contracted for the ZR-2, considered the desirability of obtaining one of the former German Zeppelins for experimental and instructional purposes.

When these German air fighters were turned over to the Allies, Italy, France and England received one each and America none. Great Britain's Zeppelin, the L-71, is the largest rigid airship in existence, now that the ZR-2 is gone. Her cubic capacity is 2,420,000 feet, or 380,000 feet less than the ZR-2. The length of the L-71 is 743 feet, as against 695 feet for the ZR-2.

New Cuban Field

An emergency landing field has been located on the Isle of Pines, south coast of Cuba, the center of which is about 3 miles 143° from the extremity of Barcos Point. This field is about 2 miles long, northeast and southwest, and 1 mile wide, flat and level, except that in spots small ruts 6 to 8 inches deep are found, which can be seen from aloft. The field is covered with short grass about 2 inches high. The surface is extremely hard in dry weather; it absorbs rain very fast and therefore is suitable for landing at any time except perhaps within two hours after a heavy rain.

Two steel towers, 80 feet high, in line northeast-southwest and 4½ miles apart, have been erected for survey purposes. The line joining these towers crosses the landing field.

There are no obstacles to approach or take off. The surrounding territory is swampy toward the coast and wooded inland.

Small parts can be made and machine work done at the garages in Nueva Gerona, 10 miles to the eastward. Fresh water can be obtained from wells about 2 miles distant and from farmhouses.

Food can be had at Nueva Gerona; trucks are available there and gasoline also. There are no telephones or railroads on the island. There is a radio station at Nueva Gerona and a mail boat leaves there every other day for Batabano, which is connected by rail with Habana.

The prevailing wind is from southwest, force 2 to 3. The rainy season begins between June 15 and July 1 and ends October 15 to 30.

Approximate position of Barcos Point: 21° 55′ 00″ N., 82° 55′ 00″ W.

Electro-Magnetic Brakes for Aeroplanes

(*Concluded from page* 57)

If the rolling of the boat and the wind is very strong, he will use more power, or else he can "flash" the electro-magnets. By this is meant to overload the electro-magnets 50 to 100 per cent. Thus, an electro-magnet usually capable of attracting a weight of 100,000 lbs., can be energized by using double the quantity of the current to give a tractive effect of over 200,000 lbs. Naturally this would be only for half a minute or so, as otherwise there would be danger of burning out the windings. However, inasmuch as the aeroplane makes a landing in less than ten seconds, the "flashing" of the electro-magnets is of no consequence. As soon as the aeroplane has come to rest the bluejackets will be ready to lash it fast, and then the current can be switched off.

THE NEW LONGREN BIPLANE

WE illustrate and describe this week the new Longren biplane, designed and manufactured by the Longren Aircraft Corporation, of Topeka, Kansas.



Front view of Longren biplane equipped with Lawrence motor

Fuselage

The fuselage is made of hard vulcanized fibre molded to a good streamline form. The fibre is fastened on the top and the bottom center lines to two ash longerons. The fibre is reinforced with laminated ash ribs, giving an exceptionally strong and rigid assembly that is resilient and shock resisting. The fibre used has a strength weight ratio double that of plywood or veneer and cannot be splintered or shattered. The combustion point of 650° F. is an added advantage over wood or fabric covering, and makes it practically fireproof. The fuselage is thoroughly water-proofed inside and outside after assembly. The cockpit opening is well reinforced with ash ribs. The side door, while permitting easy entrance and exit, is designed to preserve the full strength of the fuselage at this point.

Wings

The U. S. A. No. 2 Wing Section, slightly modified, is used. This section is especially adaptable for a commercial aeroplane of this size. The internal wing construction conforms to the best engineering practice. The spars are built up "I" sections of spruce. The ribs are made with plywood web and ash cap strips. Fittings are well standardized and interchangeable. Ailerons are fitted on the upper wing only and are interchangeable. Aileron control is by torque tube with the operating arm in line with the rear hinge of the wing. Swivels are provided on the arms to allow the wings to fold without affecting the controls. The center section is supported by four short struts and braced by streamline straps in front and a "V" tube at the rear.



Side view Longren biplane

The Warren Truss system is used and is so arranged as to allow the wings to be folded without disturbing the setting of the wings or controls. No adjustments are required for the operation. Four fitting pins are unlocked and removed and the wings folded back. For towing, the wings are braced to the body with tubes provided for the purpose. This eliminates danger from rough roads. The plane when folded can be towed behind a car from landing field or garage without damage. This folding wing feature, developed after considerable study and exhaustive experiments is by far the best solution to the housing problem ever offered.

The Empennage

The tail surfaces are made thick enough to require a minimum of external bracing, only two braces being used, and no wires. Rudder and elevators are operated by torque tube. The torque tube also acts as the front spar of these controls, the same as in the ailerons. The elevator controls are entirely enclosed in the body and the rudder control has a short arm and only a very short wire exposed. The elevators are interchangeable and also the two halves of the stabilizer. The tail skid is of the steel leaf spring type, well faired, and fastened to the lower longeron directly under the last body rib. The compression load of the skid is carried by a duralumin compression plate. The skid is of a very neat and compact design, giving maximum strength with minimum resistance.

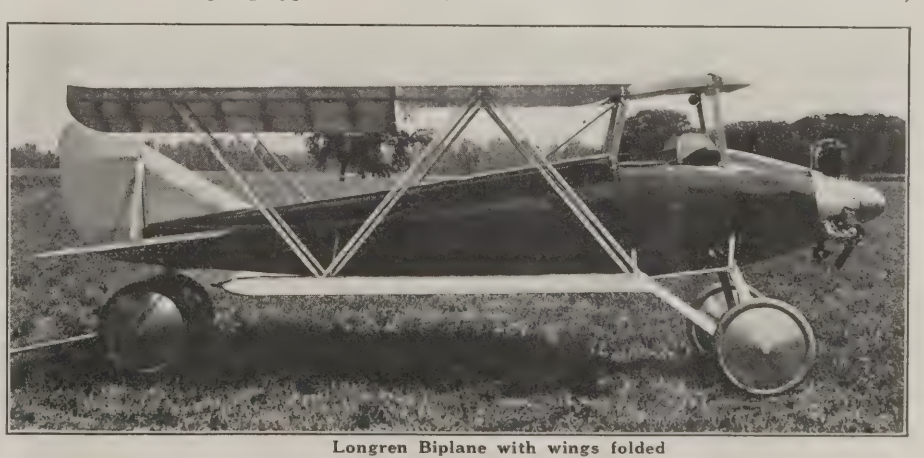
Landing Gear

The landing gear is exceedingly neat and simple in design. The streamline struts terminate at the lower end in the duralumin shock absorber housings which entirely enclose the shock absorbers. The axle is faired to give a lifting section. The leading edge of the axle fairing is used as the compression member between the landing struts. The trailing edge is attached to the axle and rises and falls with it. Both the leading and trailing edges are of duralumin. The tension members of the landing gear are streamline straps. The wheels are faired with duralumin sheet, giving a light but stiff and durable fairing.

Seats and Controls

The cockpit is entered through a side door which is designed to retain the strength of the body. The pilot and passenger sit side by side on a neatly upholstered seat of comfortable width. The seat is the same width as the Standard Pullman seat, and is well cushioned.

The standard stick and foot-bar controls are convenient for instruction and are carefully arranged to leave no moving or unsightly parts exposed. This arrangement makes a very clean and roomy cockpit with no danger of the pilot or passenger's clothing catching on any part. The aluminum instrument board is in plain view of both the pilot and passenger and carries all instruments and engine controls. These instruments include a tachometer,



Longren Biplane with wings folded

altimeter, map case, clock, gasoline gage, oil pressure gage, motometer, engine switch and engine control lever.

Baggage space is provided under the seats. A well made windshield completes the comfort of the occupants.

Engine

An Anzani six-cylinder radial air-cooled motor is bolted directly to the substantial plywood nose panel of the body, giving a strong simple mounting. The engine cowling continues the pleasing lines of the fuselage, leaving only the ribbed portion of the cylinders exposed to the air. The model illustrated is equipped with a Lawrence engine.

Specifications

Span—Upper Plane	27'-11"
Span—Lower Plane	21'-11"
Length—Overall	19'-0¼"
Wing Section,	U. S. A. No. 2 slightly modified
Height	7'-8"
Chord—Both Planes	4'-3"
Gap	4'-3"
Incidence—Upper Plane	3°
Incidence—Lower Plane	2°
Decalage	1°
Dihedral	3°
Incidence—Stabilizer	1½°
Motor and Horse-power,	Anzani air-cooled radial 60 H.P.
Weight, empty	550 lbs.
Weight, fully loaded	1,050 lbs.
Useful Load	500 lbs.
Areas—	
Wings, including ailerons	189.0 sq. ft.
Ailerons (2)	19.1 sq. ft.
Stabilizer	13.5 sq. ft.
Elevators (2)	11.4 sq. ft.
Fin	2.6 sq. ft.
Rudder	5.6 sq. ft.
Weight per square foot	5.55 lbs.
Weight per horse-power	17.5 lbs.

Overall Dimensions, Wings Folded—

Length	19'-0¼"
Width	9'-8"
Height	7'-2"

A MONEY-SAVING FORD ACCESSORY

IN view of the fact that every flying field has its army of "flivvers" we have thought it desirable to bring to the attention of our readers a new device which has been developed, and which has given remarkable results in increase of power and saving of gasoline.

The illustration shows the Simpson Flexeco "30" which consists of a brass cone-shaped device and a spiral spring.

The object of the device is to break the gas up into the finest possible vapor, and thus improve the operation of the motor.

At 20 miles per hour the position of the Flexeco "30" would be as shown in this cut, some vapor passing up through the chamber inside the cone, and more vapor whirling up around the outside of the cone. The vapor passing through inside of cone is thoroughly broken up by slot-shaped ports. The vapor passing up on outside of cone is broken up by whirling motion and by striking deflecting flange at top of cone.

At speed greater than 20 miles per hour, the cone lifts still higher, due to increased suction from the motor, and allows an additional amount of vapor to pass up around outside of the cone.

At slow speed, the spiral spring holds cone down so that the flange at top of cone rests on shoulder of carburetor chamber, thus closing the opening around cone and forcing vapor to pass through inside of cone.

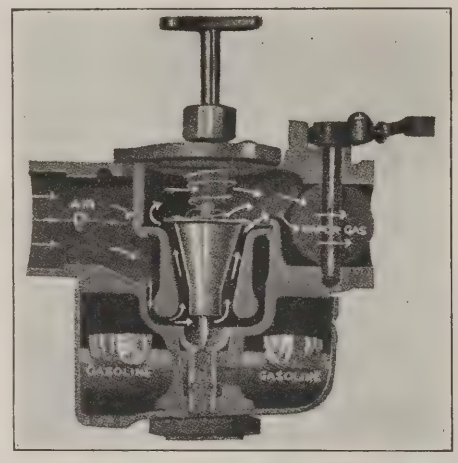
This device automatically regulates the gas mixture, so that maximum efficiency and gasoline saving is being obtained at all time thus increasing the mileage 30% to 50%.

The device is being distributed by the Pyrene Manufacturing Co., 17 East 49th Street, New York, who have received the following communication concerning tests at the Polytechnic Institute:

Gentlemen: I beg to submit to you the results of road tests made to determine the merits of your attachment for the Holley Carburetor. The carburetor adjusted on both sets of trials so that the mixture was as weak as permissible and still retain the full hill-climbing power of the motor. During the tests with your device your needle was ½ turn open and with the regular Holley needle was ⅝ turn open, these being found by trial to be the smallest permissible openings.

Results of Tests

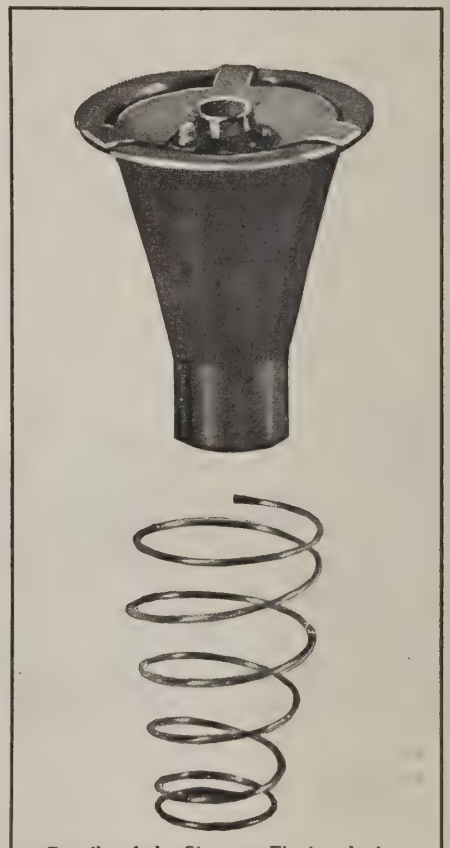
1. *Driving characteristics.* In acceleration your device showed superiority particularly on lean mixtures, there being no sign of hesitation and absolutely no backfiring when the throttle was suddenly opened wide. This was not true with the regular Holley Carburetor.



Standard Ford Holley carburetor with Simpson Flexico device installed

2. *Driving at slow speeds.* In driving at speeds below 10 miles per hour, your device far excelled the regular Holley, the car driving in high gear at 4 miles per hour without a hitch on a 5% grade. With the standard Holley needle the best was 7 miles per hour on the same grade.

3. *Mileage tests for economy.* These tests were run over exactly the same courses and at the same rates of speed for both sets of tests, and I believe are as accurate as it is possible to make road tests. The results are tabulated below:



Details of the Simpson Flexico device

Table of Results of the Simpson Flexeco "30" and Standard Holley Carburetor

1. Speed, miles per hour	10	15	20	25	30	
2. Your device:						
a. Miles per Gal. June 11	32.4	36.6				Dry road
b. Miles per Gal. June 13	30.	32.7	32.9	31.	29.1	Wet road
3. Regular Holley Carburetor:						
a. Miles per Gal. June 13	29.5	25.3	24.2	24.4	23.5	Dry road
Based on the above figures the increase in mileage is:		29.3%	36.0%	27.0%		

The average of the above three figures is 30.8 per cent. The above speeds were chosen as they represent average driving speeds. During the tests all measuring apparatus was carefully checked. The gasoline cocks were tested and found to be absolutely tight.

In answer to your questions, as to our opinion as to the most valuable features of your device, we believe the smoothness you add to the Ford motor—the better acceleration—increase in power—ability to idle at 4 miles per hour against Holley 7—are quite important as features, if not equal to the economy shown by the use of your device.

Respectfully submitted,

(Signed) WILLIAM J. MOORE,
Prof. of Experimental Engineering.

ELECTRO-MAGNETIC BRAKES FOR AEROPLANES

THE Australian publication "Sea, Land and air" prints an interesting article in a recent issue under the above caption. Whether Mr. Gernsback's invention is a practical one is a matter for the future to determine, but should it fulfill the claims put forth by him it will not only introduce a great element of safety in flying, especially with reference to night flying, but will go a long way towards simplifying the operation of aeroplanes from battleships.

It is a well-known fact that when the aeroplane was first brought out by the Wright Brothers, of Dayton, Ohio, one of the greatest troubles they experienced was in making a safe landing. At first wooden skidding arrangements were used, while afterwards heavy rubber pneumatic tires came into vogue to take up the shock when the aeroplane alighted.

When an aeroplane lands on a plain or a large grass plot and it comes to rest, the danger is, of course, over. As aerial science is progressing, however, and as aeroplanes are forced to alight sometimes on very narrow platforms, the landing becomes more and more dangerous due to the smaller and smaller landing area which economic conditions make necessary.

It is safe to predict that during the next twenty years our entire mode of life will have been revolutionized. Aeroplanes within ten years from now, particularly during the period of reconstruction after the late war, will become as plentiful as automobiles. The landing problem, therefore, becomes more and more important, and it goes without saying that when aeroplanes alight in a crowded city, they will not have large grass plots on which to land. Naturally, the roofs of our tall buildings immediately suggest themselves. Nor is this a new idea. There exists today in Philadelphia a hotel, the Bellevue-Stratford, which has a landing platform on its roof. But this platform has never been utilized as yet, for the good reason that it has been too dangerous, the landing area being too small.

Up to this time there has not existed a device whereby it was possible to make a landing on a small plot for the reason that when an aeroplane comes out of the sky it cannot stop instantly. Its momentum usually carries it forward as much as 100 yards. Were the aeroplane to stop abruptly, it would naturally turn either a somersault or otherwise would become wrecked. The same thing only on a smaller scale happens to an express train going at sixty miles an hour when the emergency brakes are set abruptly without the brakes gradually taking up the momentum of the train.

Recently it has been proposed to stop the momentum of aeroplanes by having them land on a wide strip of belting revolving in opposite direction to the oncoming flyer. While this idea is feasible it has never been used in practice, and it becomes obvious that it could not be used except from one direction. For instance, if the aeroplane came on at right angles to the moving belt, it would most likely be overturned. For that reason this device may be considered as impractical. Of course, when the weather is clear and the wind velocity is not great, an expert aviator will not have much trouble in alighting on a comparatively narrow runway as has been proved right along by seaplanes making successful landings on battleships. At present our Navy has quite a few battleships equipped with narrow runways as explained above, but these are useless in a heavy sea, or when a gale is blowing. The reason is that even if the aeroplane should make a successful landing, it would almost surely be tossed into the sea by the combined pitching and rolling motion of the vessel, as well as by the wind trying to blow the aeroplane into the ocean. Quite a number of accidents have happened in the past, due to these causes, and no doubt will happen in the future until some remedy is found.

Mr. H. Gernsbach, who has given this problem consideration, seems to have found an astonishingly simple solution whereby it now becomes possible for an aeroplane to make a landing on a very small area, no matter what its speed. The present invention on which patents are pending, is described herewith. Mr. Gernsbach has also offered his invention to the Navy Department in connection with hydro-aeroplanes alighting on battleships at sea.

To grasp the idea clearly one has to picture a future landing station "somewhere in the city of New York," on which a transatlantic aeroplane is just settling; the landing platform in this case being constructed of a very heavy glass. Into this glass, which by the way is transparent, are sunk a number of large powerful electro-magnets such as are commonly used for lifting purposes. The idea of the transparent glass is that powerful searchlights can be placed underneath it, and the entire glass expanse therefore will stand out sharply from its surroundings. Thus, an aeroplane from a considerable height will see the landing platform readily by night.

The electro-magnets in this case would be quite large, say fifty or sixty inches across, each being capable of attracting about 200,000 pounds. These electro-magnets are by no means futuristic ideas. Large electro-magnets are being built right now that can lift anywhere from eight to ten tons at contact.

In further explanation of Mr. Gernsbach's idea, it must be realized that the aeroplane has two iron-armoured pontoon-like projections instead of the usual wheels, or instead of the usual boats as are used on hydro-aeroplanes. It now becomes apparent that as the aeroplane comes within a few feet of these energized electro-magnets, there will ensue a powerful electro-magnetic attraction between the electro-magnets and the iron pontoons of the aeroplane. The tendency will be to pull the aeroplane down into contact with the electro-magnets, but inasmuch as the flying machine still has considerable momentum, it will not stop at once, but will glide over a number of electro-magnets until it finally comes within a few inches of the last row of electro-magnets when the maximum tractive effect will be had. The aeroplane will then be pulled down entirely so that the pontoons come into actual contact with the huge electro-magnets, completely arresting the flight of the aeroplane.

Now it must be understood, and it should be realized that these electro-magnets have no effect whatsoever upon the iron pontoons *until the latter come within two or three feet of the electro-magnets.* A metallic mass must come quite close to an electro-magnet before any appreciable attractive effect is had. From this it will be gathered that this invention does not purport to pull the aeroplane "out of the sky" as some people might think. It does not do anything of the sort. The idea simply is to arrest the motion of the aeroplane while in the act of landing and then hold the machine securely. If these electro-magnets were not used, then it undoubtedly would often happen that the aeroplane could not stop quickly enough, and in this case it might slide over the edge of the landing platform down into the streets. Also, while making a landing in a gale, such a huge machine, which necessarily must have a large wing area, becomes a toy of the elements; even if it had completely stopped, the wind might carry it away before the commander would have time to get the engines running at full speed. All this the electro-magnetic brakes will prevent. Once the aeroplane has settled, the electro-magnets will hold it as securely as if it had been riveted to the platform. Then after the landing has been made, the aeroplane can be readily secured to the platform by guys or ropes, so that the winds or storms cannot carry it away; this being only a matter of a few minutes, the power can then be turned off from the electro-magnets and no current is then used.

Another important point worth remembering is, that as the iron aeroplane pontoons fly a couple of feet above the electro-magnets the tractive effect, while not abrupt, is sufficient to retard the motion of the aeroplane gradually, and the electro-magngets in this respect will act exactly as the reversing of a ship's propellers in the water. In other words, the momentum of the aeroplane will be absorbed gradually and not suddenly. Furthermore, the pontoons may be equipped with small wheels, just extending a little distance from the lower surface if this is desired. Or, otherwise, the glass landing platform may be greased by means of some form of lubricant. If either of the two precautions were not taken, there would almost certainly ensue a terrific "grinding" action when the pontoons finally settled on the platform, and when the aeroplane was still in motion. However, these are small technical details left to our engineers; there are at present a number of simple means to effect a smooth final landing without the grinding element contained in it due to excessive friction.

One can readily realize how the invention can be adapted to hydro-aeroplanes making a landing on battleships and the like. As mentioned before, such landings at present are very dangerous, and often disastrous. The electro-magnetic brakes will do away with all this, and once a landing has been effected it will be almost impossible for the aeroplane to leave the narrow landing stage no matter how much the ship pitches, or what the wind velocity is. If the iron pontoons of the hydroplanes only engage two electro-magnets, an enormous tractive effect anywhere from two hundred to four hundred thousand pounds can be readily obtained. It is easy to realize how the invention works out in practice. As soon as the operator who is in control of the electro-magnets sees the oncoming aeroplane, he has it in his power to gradually switch on current into the electro-magnets. Thus, for instance, the two foremost electro-magnets can be energized but half or one-quarter if required, so as not to jerk the aeroplane or stop it too soon. In other words, a gradual braking action can be had at the will of the electrician in charge.

(*Continued on page* 54)

A NEW METHOD OF TESTING MODELS IN WIND TUNNELS

By W. MARGOULIS
Aerodynamical Expert, Paris Office, N.A.C.A.

WE know that the two essential conditions of the application of the law of proportionality of pressure to the product of density, the square of the linear dimensions and the square of the speed to the results of model tests are:

(1) *The Equality of Reynolds' Number.*

$$N = \frac{vl}{\nu} = \frac{VL}{\nu_1}$$

v being the velocity of the airstream in the tunnel, V being the speed of the machine in free flight, l and L—respectively one of the principal linear dimensions of the model and of the full scale aeroplane; ν and ν_1—respectively the kinematic coefficients of viscosity of the fluid circulating in the tunnel and of the air in which the machine flies.

(2) *The Equality of the Ratios of the Speed to the Velocity of Sound* (Law of Bairstow and Booth).

$$M = \frac{v}{w} = \frac{V}{W}$$

w and W being respectively the velocities of sound in the tunnel and in the air.

The first of these conditions is due to viscosity and is important especially at low speeds (tests of model aeroplanes); the second condition is due to the consideration of compressibility and must be observed at high speeds (tests of model propellers).

Now, in existing laboratories utilizing a horsepower of 100 to 300, the models are generally made to a 1/10 scale and the speed is appreciably lower than the speeds currently attained by aeroplanes; the Reynolds' Number realized in the laboratories is thus from 15 to 25 times smaller than that reached by aeroplanes in free flight, while the ratio M varies between the third and three-fourths of the true ratio.

Thus, when a model aeroplane, for instance, is tested in such a laboratory, the streamline wires resist relatively twice as much, the struts of the rigging and undercarriage five times as much, while the wings carry 30% less on the model than on the aeroplane, so that *results obtained in existing laboratories cannot be practically utilized.*

We cannot appreciably increase Reynolds' Number by increasing either the diameter (d) of the tunnel, or the velocity v of the airstream, for the motive power required for working the fan producing the airstream is proportional to $d^{1.75}v^{2.75}$ and such increase would therefore lead to installations much too costly both as to establishment and upkeep.

Thus wind tunnels are now being planned having a diameter of 3 to 5 m., speeds of 60 to 75 m/sec., and horsepower of 1000 to 1500; but the Reynolds' Numbers attained in such tunnels will still be 8 times less than those of existing large aeroplanes.

We will show, however, that it is possible to have wind tunnels in which Reynolds' Number will be greater than that now attained by aeroplanes, and in which the ratio of the velocity to the velocity of sound will also be greater than that realized in practice, and we will show that this can be done with an outlay for installation and upkeep much below that required by the laboratories now being planned.

In order to attain this result we have only to employ a gas other than air, at a pressure and temperature different from those of the surrounding atmosphere.

We will establish the expressions connecting the power:

1st. To the physical constants of the gas.
2nd. To the values of the temperature and pressure.
3rd. Either to Reynolds' Number, or to the speed of the aeroplane in free flight, or to both these values simultaneously.

1. Fundamental Formulas

We will call:

v and d respectively the speed and the diameter in the working section of a tunnel.
μ — the coefficient of viscosity at the absolute temperature T.
ρ — the density; ρ_0 — density at 1 kg/cm² and 273°.
υ — the kinematic coefficient of viscosity; $\nu = \mu/\rho$.
p — the pressure.

It can be shown† that the power drop in a closed circuit wind tunnel proceeds from two causes:

The units employed are the kilogram (unit of force), the meter, and the second.

† See in the last publication of the Eiffel Laboratory: "Résumé of principal works executed during the War," p. 184, my theory of the functioning of wind tunnels.

* "Abriss der Lehre von der Flüssigkeits und Gasbewegung," p. 20.

We assume with Prandtl* that the power drop for any fluid whatever in a cylindrical conduit of length L, is:

$$\Delta = a\, L\, \mu^{0.25}\, \rho^{0.75}\, v^{1.75}\, d^{-1.25}$$

1st. The drop caused by friction, expressed in the form:

$$P_1 = A\rho \cdot d^2v^3 \cdot \left(\frac{\mu}{\rho\, d\, v}\right)^{0.25} = A\,\rho\, d^2v^3 \cdot N_s^{-0.25}$$

(N_s being the Reynolds' Number of the tunnel.)

2nd. The second cause of power drop is the thickening of the airstream in the diffuser and the loss by impact in the bends:

$$P_2 = B\,\rho\, d^2v^3$$

If we consider that these latter losses are very small as compared with those arising from the first-named cause, we can assume as an expression of the total power drop:

$$P_1 + P_2 = \rho\, d^2v^3 \cdot N_s^{-0.25}\left(A + B\, N_1^{0.25}\left(\frac{N_s}{N_1}\right)^{0.25}\right) =$$

$$= \rho\, d^2v^3\, N_s^{-0.25}\,(A + B\, N_1^{0.25}) = C\,\rho\, d^2v^3\, N_s^{-0.25}$$

N_1 being the mean value of N in the tunnel.

If we take as a basis the results obtained in the closed circuit tunnel of the Aeronautical Institute of Rome (50 m/sec. in a flue of 2 m. diameter with 113 h.p.; coefficient of utilization $\rho^s = 2.9$) for determining the value of $(A + B\, N_1^{0.25})$, we shall come to assume as an expression of the motive power required for working the fan of a tunnel of this type utilizing any fluid whatever:*

$$P_m = 0.47\ \mu^{0.25}\ \rho_0^{0.75} \cdot \frac{p^{0.75}}{T^{0.75}} \cdot v^{2.75}\ d^{1.75} \qquad (1)$$

We shall compute the Reynold's Number for the tunnel by assuming that the span of the model is equal to 6/10 of the diameter of the flue:

$$N = \frac{0.6\ vd}{\upsilon} = 0.0164\ v\ d \cdot \mu^{-1}\ \rho_0\ p\ T^{-1} \qquad (2)$$

The velocity of sound being equal to $\sqrt{\gamma \frac{p}{\rho}}$ where γ is the ratio of the specific heats, the condition of the constancy of the ratio of the speed of translation to the velocity of sound, leads to the expression:

$$v = 0.0183 \cdot \rho_0^{-0.5}\ \gamma^{0.5}\ T^{0.5}\ V \qquad (3)$$

v being the velocity of the fluid stream in the tunnel and V the speed of the aeroplane in air at 273° and at a pressure of 1 kg/cm.²

Equations (1), (2), and (3) enable us to establish the following expressions for the power required for working the fan.

* The following table gives the values of the coefficient of viscosity μ_0 at 273° absolute, of the density ρ_0 at 273° and 1 kg/cm² pressure, of the kinematic coefficient of viscosity ν_0 at 273°, of the ratio γ of the specific heats at constant pressure and volume, and of the coefficient C of Sutherland's formula, giving the value of the coefficient of viscosity μ at the absolute temperature T of the gas.

$$\mu = \mu_0\ \frac{1 + C/273}{1 + C/T}\ \sqrt{\frac{T}{273}}$$

	$\mu_0.10^8$ (kg. sec/m²)	ρ_0 (kg. sec²/m⁴)	$\nu_0.10^0$ (m²/sec)	γ	θ
Air	1.69	0.127	13.3	1.4	114
CO_2	1.4	0.195	7.18	1.264	260
CH_3Cl (chloride of methyl)	0.99	0.251	3.94	1.2	454
Xe (xenon)	2.18	0.561	3.89	1.667	
Water	1.81	1.02	1.78	2.0830	

For water we have calculated the value of γ so as to be able to express the velocity of sound in water by a formula similar to that used for gas:

$$W = \sqrt{\gamma \frac{P_0}{\rho_0}}$$

For gases, compression and cooling diminish the value of ν, in consequence of the reduction of μ with the reduction of the temperature, and also on account of the increase of ρ; on the contrary, for water the reduction of the temperature increases the value of μ ($\mu = 19.10^6$ for T = 423°, 29.10^6 at 273 and 183.10^6 at 273°) while cooling and compression do not appreciably affect the density.

2. 1st Case—Reynold's Number Is Given; Tests of Model Aeroplanes and Airships

Eliminating v from equations (1) and (2) we have:

$$P_m = 37600 \frac{\mu^3}{\rho_o^2} \cdot \frac{T^2}{p^2} \frac{N^{2.75}}{d} \quad (4)$$

and

$$v = 61 \frac{\mu}{\rho_o} \cdot \frac{T}{p} \frac{N}{d} \quad (5)$$

Formula (4) shows that the power P_m is proportional to the term μ^3/ρ_o^2 characterizing the fluid, and to the term T^2/p^2 characterizing the conditions of temperature and pressure.

The gas which is practically most suitable to the different conditions laid down by the above formulas and by those which follow, is carbonic acid* (CO_2), as a gas having a low coefficient of viscosity, high density and a low ratio of specific heats.

For air, $\mu^3/\rho_o^2 = 301/10^{18}$; for CO_2, $\mu^3/\rho_o^2 = 72.4/10^{18}$; for $p = 15 kg/cm^2$ and $T = 253°$, $\frac{T}{T_o} \cdot \frac{p_o}{p} = 0.0618$ and $\left(\frac{T}{T_o} \cdot \frac{p_o}{p}\right)^2 = 0.00382$.

We thus see that for a given Reynold's number and with equal diameter of flues, the use of carbonic acid at 273° and 1 kg/cm² will economize ¾ of the power required with atmospheric air and that compression to 15 kg/cm² and cooling to 253° will reduce this power in the ratio of 1088 to 1, which certainly constitutes a remarkable result.

The speed will be reduced in the ratio of 1.85 to 1 in the first case and in the ratio of 30 to 1 in the second case.

3. 2nd Case—It Is Required to Realize the Same Ratio of the Velocity of Translation to the Velocity of Sound as for a Full Scale Machine Flying at a Speed V.

Eliminating v from equations (1) and (3) we obtain:

$$P_m = 0.000008 \frac{\mu^{0.25} \gamma^{1.375}}{\rho_o^{0.625}} \cdot p^{0.75} T^{0.625} V^{2.75} d^{1.75} \quad (6)$$

and

$$v = 0.0183 \rho_o^{-0.5} \gamma^{0.5} T^{0.5} V^{0.5} \quad (3)$$

We see that though there is still an advantage in having low values of μ, γ and T and a high value of ρ_o, there is, on the other hand, an advantage in *reducing* pressure.

Thus for $T = 253°$, $\left(\frac{p}{p_o}\right)^{0.75} \left(\frac{T}{T_o}\right)^{0.625} = 0.572$ for $p = 0.5$ kg/cm² and is equal to 0.164 for $p = 0.1$ kg/cm; $\frac{\mu^{0.25} \gamma^{1.375}}{\rho_o^{0.625}}$ is equal to 0.208 for air and to 0.132 for carbonic acid; $\rho_o^{-0.5} \gamma^{0.5}$ is equal to 3.32 for air and to 2.54 for CO_2*.

We see that the use of carbonic acid at 273° and 1kg/cm² reduced the power required by 40% and that if this gas is expanded to 0.5 kg/cm² and cooled to 253°, the power required is reduced by 90%. The velocity in the flue is in this case equal to 0.74 of the speed of the full scale aeroplane.

4. 3rd Case—Reynolds' Number N and the Speed V Are Given.

If it is a question of establishing a new laboratory for well determined values of N and V, we shall employ the following formula obtained by eliminating d and v from equations (1), (2), and (3):

$$P_m = 11.3 \frac{\mu^2}{\rho_o^{3/2}} \cdot \gamma^{0.5} \frac{T^{3/2}}{P} V \cdot N^{1.75} \quad (7)$$

and the diameter will be given by the formula:

$$d = 3340 \frac{\mu}{\rho_o^{0.5} \gamma^{0.5}} \cdot \frac{T^{0.5}}{p} \cdot \frac{N}{V} \quad (8)$$

established by eliminating v from equations (2) and (3).

Formula (7) shows that there is an advantage in reducing temperature and increasing pressure.

For computing *Power* we note that the values of $\frac{\mu^2 \gamma^{0.5}}{\rho_o^{3/2}}$ are $\frac{74.5}{10^{12}}$ for air and $\frac{25.6}{10^{12}}$ for CO_2*.

For $T = 253°$ and $p = 15 kg/cm^2$, $\frac{(T)^{3/2}}{(T_o)} \cdot \frac{p_o}{p} = 0.06$

For computing *Diameter* we note that:

$\frac{\mu}{\rho_o^{0.5} \gamma_o^{0.5}} = \frac{4.01}{10^6}$ for air and $\frac{2.82}{10^6}$ for CO_2* and that for $T = 253°$ and $p = 15 kg/cm^2$, $\left(\frac{T}{T_o}\right)^{0.5} \cdot \frac{p_o}{p} = 0.0642$.

In a laboratory constructed, when d is determined, we have:

$$P_m = 0.00339 \frac{\mu\gamma}{\rho_o} \cdot T \cdot d \cdot V^2 N^{0.75} \quad (9)$$

established by dividing formula (7) by formula (8), thus eliminating p.

The value of p will be determined by formula (8), which may be written:

$$p = 3340 \frac{\mu}{\rho_o^{0.5} \gamma^{0.5}} \cdot T^{0.5} \cdot \frac{N}{V d} \quad (8')$$

For determining the *Power* we note that:

$\frac{\mu\gamma}{\rho_o} = \frac{18.6}{10^6}$ for air and $\frac{9.09}{10^6}$ for CO_2*; the values of $\frac{\mu}{\rho_o^{0.5} \gamma^{0.5}}$ are given above.

We thus see that if we wish to establish a laboratory for well determined values of V and N the use of carbonic acid at 15 kg/cm² and 253° reduces the power required in the ratio of 48.5 to 1 and reduces the diameter in the ratio of 22 to 1.

In a laboratory already built the use of carbonic acid at 253° reduces the power required in the ratio of 2.2 to 1; the pressure should then be equal to 68/100 of the pressure required with air.†

We would point out that the 3rd case rarely occurs in practice; generally we have only to meet the conditions of the first or second case. We wished to treat the 3rd case, however, in order to show the wide field our method opens for aerodynamical researches on the influence, separate or combined, of viscosity and compressibility.

Remark 1.—When, in the formulas giving the value of the power in the three cases considered, we compare the values of the terms characterizing the nature of the fluid, we find that water forms the least advantageous fluid for use in a laboratory, the more so as, being incompressible, its density cannot be varied.

We may remark, however, that heating water to 100° reduces its coefficient of viscosity in the ratio of 6 to 1; in the first case it then becomes more advantageous than air at atmospheric temperature and pressure. On this subject we may say that we consider the use in wind tunnels not only of gas (that is, of fluids for which the temperature of saturation at 1 kg/cm² is below 273° absolute) but also of vapors, which must be heated so that their temperature is above the temperature of saturation at the pressure at which they are utilized. Thus we may consider using water vapor, although its characteristics ($\mu_o = 0.89 \times 10^6$, $\rho_o = 0.079$) are not favorable.

---

* Other gases, such as chloride of methyl (CH_3Cl) and Xenon would give better results but could not be practically employed. Thus μ^3/ρ_o^2 is equal to $571/10^{18}$ for water, to $15.6/10^{18}$ for CH_3Cl and to $33/10^{18}$ for Xe. It is evident that in the formulas we must always assume for water $p = 1 kg/cm^2$ and $T = 273°$.

* $\frac{\mu^2 \gamma^{0.5}}{\rho_o^{3/2}} = \frac{4600}{10^{12}}$ for water, $\frac{9.34}{10^{12}}$ for CH_3Cl and $\frac{14.6}{10^{12}}$ for Xe

$\frac{\mu}{\rho_o^{0.5} \gamma_o^{0.5}} = \frac{0.124}{10^6}$ for water, $\frac{1.8}{10^6}$ for CH_3Cl and $\frac{2.26}{10^6}$ for Xe.

$\frac{\mu \cdot \gamma}{\rho_o} = \nu_o \gamma = \frac{37,100}{10^6}$ for water, $\frac{4.75}{10^6}$ for CH_3Cl and $\frac{6.48}{10^6}$ for Xe.

* $\frac{\mu^{0.25} \gamma^{1.375}}{\rho_o^{0.625}}$ is equal to 1780 for water, to 0.0967 for CH_3Cl and to 0.0557 for Xe; $\rho_o^{-0.5} \gamma^{0.5} = 14.3$ for water, 2.18 for CH_3Cl and to 1.72 for Xe.

† We know that in phenomena into which viscosity enters, and especially in the movement of fluids in ducts, the power drop per unit of length is represented by a formula of the following form:

$$\Delta = a \, v^{2-n} d^{1-n} \mu^n \rho_0^{1-n} p^{1-n} T^{n-1}$$

It follows that the terms of formulas 4, 7 and 9, characterizing the fluid and the conditions of temperature and pressure, remain the same, whatever be the value of n (according to Prandtl, n = 0.25); only the numerical coefficient and the exponent of N vary. It is the same for all the terms of formulas 3, 5 and 8. In other words, the ratios of the power established in cases 1 and 3, and the ratios of the speeds and pressures established in cases 1, 2 and 3 constitute values independent of the assumed value of n.

Remark II.—In our theory of wind tunnels, we have called the coefficient of utilization of a tunnel (ρ_s), the ratio of the kinetic energy of the fluid stream in the working section to the power of the engine running the fan.

For the closed circuit tunnels which we are studying, this coefficient takes the very simple form:

$$\rho_s = \frac{0.393\ \rho\ d^2\ v^3}{7\ \rho\ d^2\ v^3\ N_s^{-0.25}} = 0.0561\ N_s^{0.25}$$

$N_s = vd/\nu = N/0.6.$

5. Preliminary Project of a Wind Tunnel

As a practical application let us consider a closed circuit tunnel, 2 m. in diameter, utilizing carbonic acid.

For tests of Model Aeroplanes we use carbonic acid compressed to 15 kg/cm² and cooled to 253° and we fix a speed of 30 m/sec. (corresponding, according to formula (3), to a sped in the air of 41 m/sec.).

The power required given by formula (1) will be 300 H.P. and the Reynolds' number realized will be 81.10^6 and equal to that realized by the largest existing aeroplanes (N is greater for large aeroplanes going slowly than for small planes flying at a high speed). This Reynolds' number will correspond to that of a racing plane flying at 650 km/hr.

The large laboratories now being planned will realize Reynolds' numbers 8 times smaller with powers about 4 times greater . If, in one of these laboratories having a diameter of 3 m., we wished to attain $N = 81.10^6$, we should require a power of $300 \times 1088 \times 2/3 = 217{,}000$ H.P.*

For high speed tests, and especially for Propeller tests, the pressure must be below 1 kg/cm². Thus formula (1) shows that with carbonic acid at 0.5 kg/cm² and 253°, the speed realized with the same power of 300 h.p. would be:

$$30 \times \left(\frac{15}{0.5}\right)^{0.75/2.75} = 30 \times 2.53 = 76 \text{ m/sec.}$$

equivalent to a speed in the air of 76/0.74 = 103 m/sec., that is 370 km/hr.

If the pressure is reduced to 0.1 kg/cm², the equivalent speed in the air would be 570 km/hr., with an economy in power of 90%; to attain such a speed an ordinary tunnel of 3 m. would thus require $300 \times \left(\frac{3}{2}\right)^{1.75} \times 10 = 6000$ h.p.

Lastly, we would say a few words on the realization of this wind tunnel.

There should be a closed circuit flue with continuous wall formed of thick sheet metal and protected from over-heating. Two doors sliding perpendicularly to the axis of the flue will isolate the working section while the model is being handled. The measuring devices will be placed in an airtight cabin on the wall of the working section, so that the rods of the model supports can traverse the wall of the flue by joints which should not be airtight. The measurements will be registered automatically by apparatus installed either in the cabin and visible from outside, or actually installed outside the cabin. In the latter case the apparatus will consist of manometers connected with dynamometric capsules placed in the cabin. The propeller-fan will have adjustable blades so that it can be adapted to the density of the fluid used in the tunnel.

6. Graphical Representation of the Functioning of a Wind Tunnel of Our System

We will define the functioning of a tunnel by the correlative values of N and V which can be obtained in it.

For a tunnel of our system these values are given by equation (9), from which we deduce:

$$V^2\ N^{0.75} = \frac{P_m}{0.00339\ \nu_0\ \gamma\ .\ T\ .\ d} \qquad (9')$$

For the tunnel 2 m. in diameter, studied above, utilizing CO_2 at 253° we have:

$$V^2\ N^{0.75} = 64500\ .\ P_m \qquad (9'')$$

If in a system of rectangular axes (see Fig. 1) we lay off the values of V in abscissa and the values of N in ordinates, the functioning of the tunnel will be figured by a sheaf of iso-P_m lines.

The scales being logarithmic, this sheaf will be composed of parallel lines.

To each group of values of V and N will correspond a value of p, determined by formula (8'):

$$p = 3340\ \frac{\mu}{\rho_0^{0.5}\ \gamma^{0.5}}\ .\ T^{0.5}\ \frac{N}{V\,d} \qquad (8')$$

or, for the tunnel under examination:

$$p = 74900\ \frac{N/10^6}{V} \qquad (8'')$$

The values of p will thus be represented on Fig. 1 by a sheaf of iso-p lines plotted by formula (8").

If we take the maximum value of p to be 15 kg/cm and the minimum value 0.1 kg/cm², the field of realizable values of N and V will be limited:

1st. By the iso-P_m line corresponding to the maximum power of the engine of the tunnel; we have indicated the iso-P_m = 300 H.P. by a heavy line.

2nd. By the iso-p lines corresponding respectively to 0.1 and 15 kg/cm², also marked in heavy lines.

Any group of values of V and N found within these limits may be realized by a tunnel of our system.

The value of N will be determined by multiplying the Reynolds' number of the full scale machine in flight by 0.6/1, 1 being the quotient of the dimension used in determining the Reynolds' number, and the diameter of the flue.

Example.—Test of a 1/10 model of a strut 30 mm. in diameter, of an aeroplane whose sped is 50 m/sec. We have:

$$N_m = \frac{0.03 \times 5^0 \times 10^6}{13.3} \times \frac{06.}{0.003/2} = 0.113 \times 10^6 \times 400 = 45.10^6$$

We see on Fig. 1 that the point $N = 45.10^6$, V = 50 m/sec may be realized with 290 horsepower and a pressure of 7.2 kg/cm².

7. Comparison of an Ordinary Type Tunnel with a Tunnel of Our System

For an ordinary wind tunnel the Reynolds' number N is proportional to the speed V. The functioning of ordinary tunnels will thus be represented by a line parallel to the iso-p lines; the extremity of this line will correspond to the speed determined by the maximum power of the engine of the tunnel.

On Fig. 1 we have drawn the lines corresponding to the following tunnels: Eiffel (E_1 and E_2); St. Cry (C_1 and C_2); National Physical Laboratory (N_1 . . . N_5); Rome (R); Göttingen (G).

The graph shows in a very suggestive way the superiority of our system of tunnel; as a matter of fact, in our system there is much greater scope for variations of N and V (a surface instead of a line) and the power absorbed is much more advantageously utilized.

8. Comparison of the Values of Reynolds' Number and of the Speed of Aeroplanes, Airships, and Propellers with the Values Realized in Our Tunnel

Let l_a l_d l_H and l_h be the ratios of the dimension of the model used in determining Reynolds' number, to the diameter (d) of the tunnel.

We will assume:

l_a = span of the model aeroplane/d = 0.6

l_d = diameter of model airship/d = 0.15

l_H = diameter of model propeller tested alone/d = 0.5

l_h = diameter of model propeller tested on model aeroplane/d; this value varies according to type of machine.

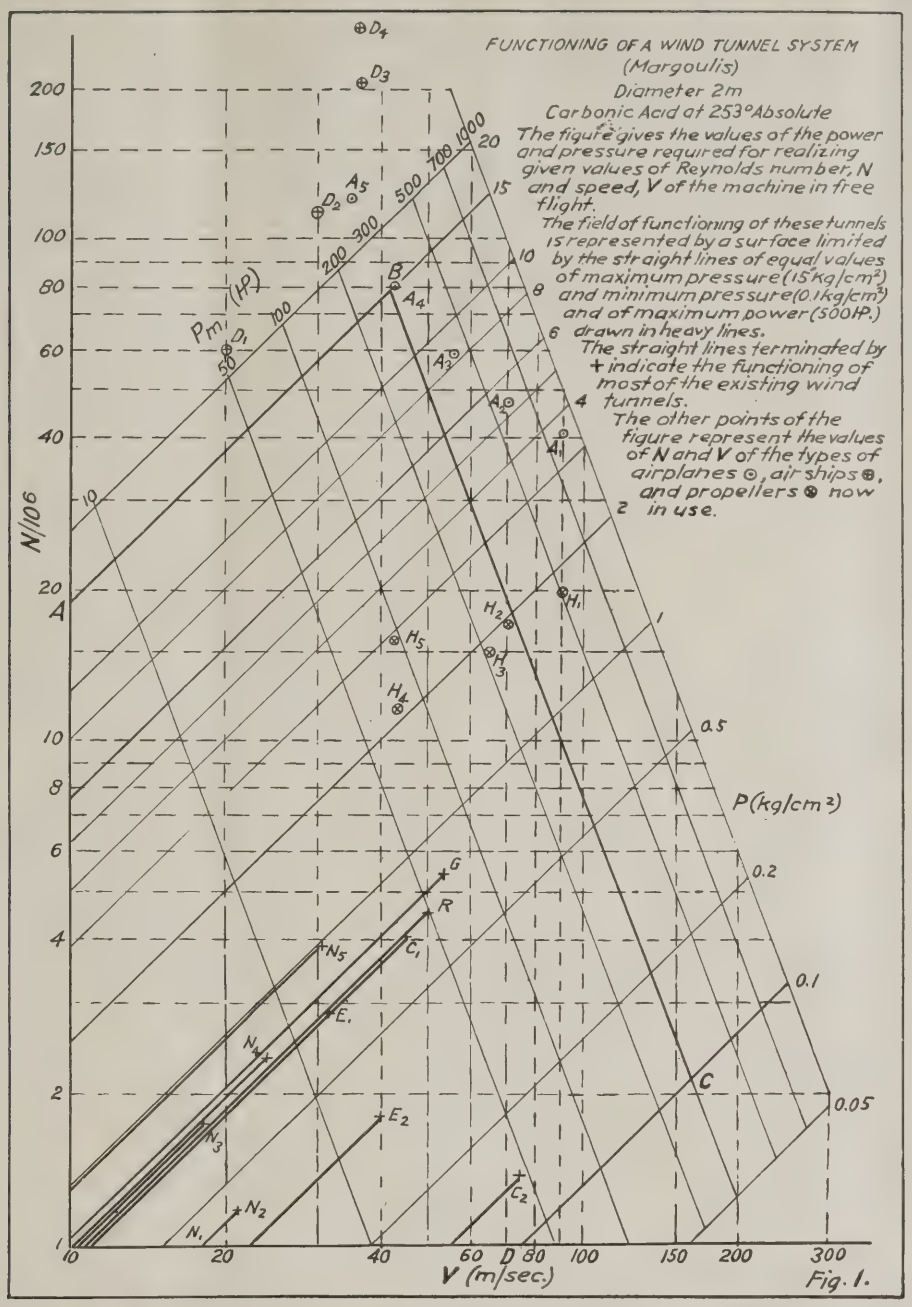
As in all our computations we have assumed: $N = 0.6\ \frac{vd}{\nu}$, the values of Reynolds' number must in each case be multiplied by 0.6/1; thus for aeroplanes $0.61/l_a = 1$; for airships $0.6/l_d = 4$; for propellers tested alone $0.6/l_H = 1.2$ and for propellers tested on a model aeroplane and on its scale $0.6/l_h$ = span of plane/diameter of propeller, so that $N_h = N_a$, which, moreover, was evident *a priori*.

The following table gives the values of N_a, N_d, N_H and N_h for different existing machines, the value of ν being $\frac{13.3}{10^6}$ m²/sec.

Aeroplanes	Span (m)	Speed (m/sec)	$N.10^6$	$N.10^6 \times 0.6/l_a$
Racing Plane (A_1).....	6	90	40.6	40.6
Pursuit Plane (A_2).....	9	70	47.4	47.4
Medium size transport plane (A_3)	14	55	58	58
Large transport plane (A_4)	25	43	81	81
Giant aeroplane (A_5)....	42	35	110	110

Airships	Diam.			$N.10^6 \times 0.6/l_d$
Small flexible airship (D_1)	10	20	15	60

* This figure must be considered rather as a proof of the impossibility of realizing this Reynolds' number in an ordinary tunnel than as an exact value of the required power. As a matter of fact the speed in this case should reach 900 m/sec. and we have not the right to apply our formulas to such speeds, for which, moreover, the phenomena of compressibility would completely distort the results.



Large flexible airship (D_2)	15	25	28.2	113
Transport Zeppelin (D_3)	18.7	36.8	51.7	207
Military Zeppelin (D_4)	23.9	36.4	65.4	251

Propellers	Diam. (m)	Speed (m/sec.)	N.10⁶	N.10⁶.$\frac{0.6}{1_H}$	N.10⁶.$\frac{0.6}{1_h}$
Racing Plane (H_1)	2.4	90	16.2	19.5	40.6
Pursuit Plane (H_2)	2.7	70	14.2	17.1	47.4
Medium size Plane (H_3)	3	55	12.4	14.9	58
Large Plane (H_4)	3	43	9.7	11.6	81
Giant Plane (H_5)	5	35	13.2	15.8	110

In examining the positions of the points representing the values of N, V for any machine whatever, it should always be remembered that it is of little importance if the model of a low speed machine does not attain the same speed in the tunnel as in flight and also that it does not much matter if a high speed machine does not attain its Reynolds' number in the tunnel.

This being understood, we see that with 300 horsepower we realize for large aeroplanes the conditions of Reynolds' number and speed and that if the speed conditions are not realized for small rapid machines, that is of no importance so long as the Reynolds' number is attained.

For large airships only the half of N is reached, but, considering its very high value, this should not lead to error.

Finally, for propellers tested on the model and on the same scale as the model, we realize, as for large aeroplanes, the conditions of similitude imposed by the considerations of viscosity and compressibility.

For small high speed planes we shall adopt either mean values (for instance, for a pursuit plane; 60 m/sec., 4 kg/cm² and N = 30.10^6 instead of 47.10^6) of V and N, or extreme values of V and N according to whether we are studying the functioning of the propeller or of the aeroplane.

Remarks.—In the application just given of our system to a tunnel of 2 m. in diameter, we assumed, in order to deal with a general case, that the carbonic acid was cooled to —20° C.

Practically, this cooling leads to complications in installation and functioning which the resulting small gain of power does not justify—see formulas (), (6), and (7).

We therefore consider it preferable to work at the temperature of the surrounding atmosphere. If we assume a mean temperature of + 10° C, formulas (9) and (8′) show that for the same values of V and N the power is increased by 11% and the pressure by 6%, with respect to those corresponding to a temperature of —20°.

In Fig. 1 the graduations of the lines of equal values of P_m must thus be increased by 11% and the graduations of the lines of equal values of p by 6%.

It follows that the limits of functioning of our wind tunnel will be the same as those given above, on condition of employing 335 H.P. at pressures varying between 0.106 and 15.9 kg/cm².

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Consolidated Statement of the Performance of the Air Mail Service —Fiscal Year 1921 (July 1, 1920 to June 30, 1921)

Month	Trips Possible (Sched'l'd)	Trips Attempted	Trips Defaulted	Trips Uncompleted	Weather Encountered: Trips in Fog, etc.	Weather Encountered: Trips Clear	Mileage Possible (Scheduled Mail Trips)	Miles Traveled with Mail	Miles Traveled Testing, Ferrying, etc.	Total Miles Traveled	Per cent of Performance	Mail Carried (Lbs.)	Cost of Service	Forced Landings Due to: Mechanical	Forced Landings Due to: Other Causes
July, 1920.....	260	253	7	7	40	213	71,500	69,140	4,862	74,002	96.69	68,401	$85,993.59	25	14
August.....	368	347	21	19	55	292	479,502	73,456	42,567	116,023	92.42	73,140	73,026.93	39	29
	(Transcon	tinental ser	vice inaugu	rated Septe	mber 8th)										
September.....	696	502	194	30	390	112	143,322	105,847	25,355	132,202	73.84	91,150	108,751.76	47	30
October.....	750	593	157	57	190	403	154,700	123,274	31,212	154,486	79.68	89,541	123,618.68	54	59
November.....	758	575	183	77	230	345	156,076	114,750	25,009	139,759	73.50	87,302	121,501.18	85	69
December.....	884	662	222	105	347	315	178,776	127,306	3,734	131,040	71.21	89,942	131,205.96	89	138
January, 1921...	850	697	153	87	253	444	171,900	132,679	6,930	139,609	77.18	84,435	136,488.61	117	131
February.....	782	660	122	71	310	350	159,238	130,431	13,224	143,655	81.90	88,135	131,855.43	82	122
March.....	918	871	47	59	351	520	185,652	171,593	15,032	186,625	92.42	110,117	152,442.27	64	123
April.....	684	837	47	36	370	467	178,776	171,156	15,794	186,950	95.73	117,778	147,890.64	79	107
May.....	850	833	17	20	320	513	171,900	168,397	12,819	181,216	97.96	115,073	125,754.74	72	81
June.....	832	829	3	10	268	561	168,656	156,956	18,135	185,091	99.00	105,838	127,479.83	57	51
Totals.....	8,332	7,659	1,173	578	3,124	4,535	1,819,976	1,554,985	215,673	1,770,858	85.96	1,120,852	$1,466,009.62	810	954

Regular service between Omaha, Neb., and San Francisco, Cal. (part of the Transcontinental Route)—started September 10, 1920.

Service between Chicago, Ill., and St. Louis, Mo. (part of the Twin Cities (St. Paul and Minneapolis)-St. Louis Division)—started August 16, 1920.

Regular service between Chicago, Ill., and Twin Cities (St. Paul and Minneapolis) (part of the St. Louis-Twin Cities Division)—started November 29, 1920.

New York-Washington Division was discontinued May 31, 1921.

St. Louis-Twin Cities Division was discontinued June 30, 1921.

Repair Depot, Bustleton, Pa., was consolidated with Chicago Repair Depot, June 30, 1921—Bustleton Field abandoned same date.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Consolidated Report of Operation—Fiscal Year 1921

Month	Gasoline Cost	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles and Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	Interest on Investment	TOTAL
July, 1920.....	$9,706.72	$1,644.57	$32,658.12	$5,280.67	$3,204.68	$ 910.19	$5,014.24		$7,119.93	$11,774.69		$4,891.07	$3,588.71	$85,993.59
August.....	13,507.96	2,366.33	10,281.31	3,164.65	3,406.33	1,081.38	5,642.49		10,520.91	13,641.02		4,177.03	5,237.02	73,026.93
September.....	18,805.41	2,866.66	17,059.07	13,536.60	4,473.52	1,627.13	7,168.20		13,524.08	19,501.90		4,270.51	5,918.62	108,751.76
October.....	60,959.94	3,840.85	22,571.32	16,264.81	5,827.95	1,813.91	8,501.34		10,989.85	21,204.47		5,448.06	6,196.18	123,618.68
November.....	17,635.97	3,920.24	18,626.50	16,511.32	5,197.57	2,511.17	9,081.01		16,460.01	19,510.24		6,289.69	5,757.46	121,501.18
December.....	17,783.40	3,814.04	21,072.46	21,529.14	5,199.62	2,954.73	12,310.29		15,816.07	20,564.00		4,031.01	6,131.20	131,205.96
January, 1921..	18,558.44	4,303.29	28,006.76	18,790.86	6,010.07	3,405.32	12,136.21		15,432.13	19,583.76		3,880.59	6,381.18	136,488.61
February.....	18,823.70	3,824.18	17,689.41	20,464.60	6,581.91	3,904.82	12,025.41		16,246.74	18,388.37	4,744.81	3,775.30	5,386.18	131,855.43
March.....	22,896.17	4,970.33	33,531.52	17,827.86	6,832.30	3,792.54	11,270.34		17,851.24	19,912.92	4,583.10	3,725.75	5,248.20	152,442.27
April.....	22,956.61	5,554.75	31,321.32	12,829.73	6,457.85	2,559.12	12,254.29	4,277.72	17,965.49	18,577.71	9,834.41	3,301.64		147,890.64
May.....	21,752.41	4,870.72	15,217.83	10,551.05	5,666.64	2,277.41	11,868.01	4,484.67	17,708.11	16,595.44	11,184.21	3,578.24		125,754.74
June.....	19,624.03	4,544.75	27,921.81	8,236.00	3,918.51	1,110.32	9,493.98	4,524.12	18,897.17	17,343.52	8,602.67	3,262.90		127,479.83
TOTAL.....	$223,010.81	$46,720.71	$275,957.43	$164,987.29	$62,777.45	$27,948.04	$116,765.81	$13,286.51	$178,531.73	$216,598.04	$38,949.20	$50,631.79	$49,844.81	$1,466,009.62

SERVICE AND UNIT COST

Month	Gallon of Gas	Time Hr.	Time Min.	Miles Flown	Cost per Hour	Cost per Mile
July, '20...	31,956	912	42	74,002	$94.22	$1.16
August....	39,812	1,477	50	116,023	49.41	.63
Sept.....	53,877	1,629	40	132,202	66.72	.82
October....	60,010	1,852	56	154,486	66.71	.80
November.	50,573	1,651	20	139,759	73.57	.87
December..	49,844	1,569	28	131,040	83.60	1.00
Jan., '21...	51,427	1,668	51	139,609	81.78	.98
February..	68,898	1,733	04	143,655	76.08	.92
March.....	66,929	2,103	36	186,625	73.18	.82
April	66,854	2,175	04	186,950	67.98	.79
May.....	64,322	2,041	29	181,216	61.08	.69
June.....	57,873	2,148	27	185,091	59.33	.69
Totals and Averages..	662,175	20,964	27	1,770,658	$71.13	$0.8475

COST PER MILE

Month	Overhead	Flying	Maint'nce
July, '20...	$0.24	$0.25	$0.67
August....	.17	.23	.23
Sept.....	.18	.26	.38
October....	.18	.23	.39
November.	.21	.27	.39
December..	.23	.29	.48
Jan., '21..	.23	.27	.48
February..	.25	.27	.40
March.....	.19	.25	.38
April.....	.18	.25	.36
May.....	.19	.24	.26
June.....	.15	.23	.31
Averages...	$0.20	$0.25	$0.39

Regular service between Omaha, Neb., and San Francisco Cal. (part of the Transcontinental route)—started Sept. 10, 1920

Service between Chicago, Ill., and St. Louis, Mo. (part of the Twin Cities (St. Paul and Minneapolis)-St. Louis Division)—started August 16, 1920.

Regular service between Chicago, Ill., and Twin Cities (St. Paul and Minneapolis) (part of the St. Louis-Twin Cities Division)—started November 29, 1920.

New York-Washington Division was discontinued May 31, 1921.

Prior to April, 1921, cost of maintaining warehouse was included in "Miscellaneous," and prior to February 1921, cost of radio was also included in "Miscellaneous."

Repair Depot, Bustleton, Pa., consolidated with Chicago Repair Depot, June 30, 1921—Bustleton Field abandoned same date.

St. Louis-Twin Cities Division was discontinued June 30, 1921.

Overhead consists of: Departmental Overhead, Office Force, and Watchmen, Motorcycles and Trucks, Rent, Light, Fuel, Power, Telephone and Water, Interest on Investment, Radio.

Maintenance consists of: Miscellaneous, Mechanics and Helpers, Repairs and Accessories, Warehouse.

Flying consists of: Gasoline cost, Grease and Oil, Pilots.

NAVAL and MILITARY AERONAUTICS

Rockaway Station Stays Another Month

The Navy Department has found ways and means for keeping the Rockaway Park Naval Air Station open another month. Recently Captain Damon E. Cummings, commandant of the station, was ordered by the Navy Department to close down the station. All the seaplanes and blimps were sent to other stations and the officers were preparing to demobilize or transfer the enlisted men.

The decision to give up the air station, which guards the approaches to this city, was based on the refusal of the city to turn over to the navy the land which the station occupies. This land is part of the Jacob A. Riis Park. Hope has been revived that the city may reconsider the Navy Department's request.

General Mitchell Courageously Defends Air Service

A sensational chapter has been added to the "aircraft versus capital ships" discussion that has caused so much comment in Washington this year.

This new development comes from a report made by Brig. Gen. William Mitchell, Assistant Chief of Air Service, published in the New York *Times* September 14, on the bombing tests held two months ago off the Virginia Capes. The report was submitted to Major Gen. Charles T. Menoher, Chief of the Air Service, in the form of a memorandum.

The report has not been issued for publication by the Chief of Air Service. Its appearance is expected to cause a greater sensation than that which occurred in the Air Service administration last Spring when General Menoher warned General Mitchell to "speak softly."

Statements made by General Mitchell in his report flatly contradict the reports submitted by the Congressional committee that witnessed the bombing tests. Those high in political circles believe that there may be a housecleaning in the Air Service when the story "gets around."

The outstanding statements in the Mitchell report are:

Aircraft can operate under conditions when seacraft is helpless.

Aircraft can safely protect the entire coast.

Seacraft should cease operations when within 200 miles of the coast.

All naval activities should be confined to the high seas.

Had the army air service been permitted to attack as it desired, the seacraft attacked would not have lasted ten minutes.

The first provisional air brigade could have put out of action the entire Atlantic fleet in one attack.

The problem of destruction of seacraft by airplane is finished. It has been solved.

The scheme of national defense should be revised at once on the following basis: A department of national defense, with sub-secretaries for army, navy and air service; a department of aeronautics coequal with the Departments of War and Navy must be created at once.

The report stated that at present there is a complete lack of liaison or system about our national defense. It scored the present coast defense system, asserting that at least $1,870,000,000 had gone to create a coast defense that is little more than useless against hostile aircraft and hostile sea forces.

Following are excerpts from General Mitchell's report as published in the *Times:* "Air forces with the types of aircraft now in existence or in development, acting from shore bases, can find and destroy all classes of seacraft under war conditions with a negligible loss to the aircraft. It is not necessary to destroy hostile seacraft at a distance greater than twenty-five miles off shore in order to protect the coast, as this distance exceeds the range of the most powerful guns at present installed. Aircraft, acting from suitable floating airdromes, can destroy any class of surface seacraft on the high seas.

"Conditions of weather affecting the air and sea conditions do not alter the statement made above, as aircraft can operate in conditions under which seacraft cannot operate. There are no conditions in which seacraft can operate efficiently in which aircraft cannot operate efficiently.

"The weapons used in the recent exercises against the seacraft were bombs alone. Torpedoes, gas, gunfire and mines were not employed. The army air service was not permitted to attack the targets, as it would under actual conditions, and never was more than one-tenth of the brigade employed in a single attack.

"Had the army air service been permitted to attack as it desired, none of the seacraft attacked would have lasted ten minutes in a serviceable condition. The first provisional air brigade could have put out of action the entire Atlantic Fleet in a single attack. The value of the airplanes in the first brigade did not exceed the cost of a modern destroyer."

General Mitchell then explains how battle ships under war conditions are much more vulnerable than the targets used in the bombing tests. A battleship with full steam up and speeding ahead is a target much easier to hit and to put out of commission than the targets used, he asserts.

"The problem of destruction of seacraft by forces has been solved and is finished," the report goes on. "It is now necessary to provide an air organization and a method of defending, not only our coast cities, but our interior cities against the attack of hostile air forces. Our recent maneuvers show an enemy having gained control of the air—which gives him control of the sea—may land air forces from aeroplane carriers on any of the islands or keys along our coast, which cannot attack by troops or artillery, and from those points launch air attacks against our great centres of population, extending even to Chicago, St. Louis and other Middle Western cities."

The report then explains how Chicago, St. Paul, Omaha, Kansas City and other cities in the Central West would be laid open to aeroplane attacks and their cities bombed with high explosives and the citizens killed with gas and incendiary bombs.

In conclusion, General Mitchell makes the following recommendations:

1. The establishment of an air force for frontier and coast defense.
2. The equipment of the navy for offenses on the high sea, and not for coast work.
3. Navy control should cease 200 miles from shore, protection of the land and the coast defense being left to the army and the air service.
4. A more co-ordinate and working understanding between the different arms of the service. The present system, a heritage of our early wars, has clearly demonstrated that the present lack of co-operation is a serious fault.

The Alabama Bombing Tests

In a detailed program made public September 17 by the War Department, the objects of the Alabama bombing tests are set forth as follows:

"To determine what explosives or gas effect is needed to put seacraft out of action. It has been demonstrated that seacraft may be utterly destroyed; but obviously, if the system of fire control, communication and mechanical installations of vessels can be disrupted and the nervous systems of the human beings who man seacraft can be shattered, the efficiency of the craft is destroyed without necessarily sinking it.

"To determine the effect of smoke bombs in concealing the attack of aircraft and of the effect of white phosphorus clouds in neutralizing anti-aircraft elements.

"To determine the effect of machine gun fire and fragmentation bombs in clearing the ship's decks of anti-aircraft units.

"To determine the feasibility and effect of night attacks on seacraft."

A board of observers consisting of three air service officers, two ordnance officers and two officers of the Chemical Warfare Service will inspect the results of tests and attacks on the Alabama.

In the preliminary tests a sufficient number of bombs and flares of all types will be dropped to determine the effect of each and the best method of tactical employment. It is anticipated that experiments with tear gas bombs will give important data on the attack of battleships by gas bombs. In similar manner the effect of phosphorous and smoke bombs will be determined. It is believed that smoke screens may be used with great effect in protecting the attacking airplanes from anti-aircraft defenses of seacraft. In order to determine this a series of tests will be held in which the various branches of aviation will make stimulated attacks on the battleship through smoke screens.

The tactical effectiveness of flares in illuminating attack of battleships will be determined in the preliminary tests as well as the effect of white phosphorus in outlining seacraft at night with sufficient distinctness to permit accurate attacks. Tests also will be conducted to determine the effect of the 1,100-pound armor piercing bomb.

FOREIGN NEWS

Aeronautical Commission of Control, Hungary

An Aeronautical Commission of Control for Hungary has been formed with effect from August 1, 1921. Wing Commander J. N. Fletcher, A.F.C., is chief of the British Delegation. The Headquarters are at Budapest. The Aeronautical Commission of Control for Austria ceased to exist from August 1, 1921.

Three French Firms Amalgamate

According to reports from Paris, three of the largest French aircraft firms have joined forces, the new firm to be known as Nieuport-Astra. The three firms are Nieuport, Astra, and Compagnie Générale Transaérienne. There will be few changes in staff in the new firm. M. Delage, who has for a good many years been chief designer and engineer to the Nieuport firm, will remain in this capacity as regards the aeroplane, seaplane, and boat-building departments. The airship department will be under the technical direction of M. Henry Kapferer. M. G. Gradis is chairman of the new company, with M. Thomas as general manager and M. L. Bazaine as commercial manager. The Nieuport machines will in future be known as Nieuport-Delage, much in the same way as the Spads are known as Spad-Herbemont. In this manner there is no possibility of confusing the French Nieuports with the British and other Nieuports which have no longer any connection with the original firm.

Munich Preparing for Air Traffic

The Bavarian authorities are making arrangements to establish a first-class air station at Munich. Discussions between the Federal States have taken place on Munich's favourable situation in relation to the Continental airways.

A Zepp. Hangar for Denmark

The Entente has, writes the *Morning Post* Copenhagen correspondent, offered to sell to Denmark the great Zeppelin shed at Tonder, and probably Denmark will accept the offer. As the removal of the shed is at present too expensive an undertaking for the Government, it intends to leave the structure where it is at present, removing the smaller aeroplane hangar to Copenhagen.

Prague's Second International Aero Exhibition

Particulars of this exhibition to be held from October 22 to 30 next at Prague—originally it was to take place the latter part of September—have now been issued. It is under the patronage of the Czecho-Slovakia President, T. G. Masaryk, and is to be held at the Palace of Industry, Prague, organized by the Ceskoslovensky Aviaticky Club, Praha I. Obecni dum. This second exhibition is a result of the very successful show held in 1920, and it is anticipated that the October exhibition will far surpass last year, and justify the claim of the organizing Club that "Prague is geographically the chief point in Central Europe as well as the center of all Slav commerce, and therefore will certainly hold the leading position in aeronautics." Following the close of the Exhibition, firms will, on November 6, have an opportunity of giving practical proof of the flying powers of their exhibited machines, if they so desire, at the Kbely Aerodrome. Anyone interested in the exhibiting side of this fixture should write for full particulars to the General Secretary, Charles Hypsa at the Club, as above.

Aviation in the Philippines

That interest in aviation is growing in the Philippines is manifest by the letters received at Clark Field recently from the Provinces of northern Luzon.

In compliance with a request from the municipal authorities of Mangatarem, Pan., an officer from Clark Field was ordered to that municipality for the purpose of locating a landing field that could be used the year round.

The officer making this inspection spent several days looking over the different sites and reports a most cordial welcome from the people of Mangatarem. During his stop he was the guest of the Municipal Presidente, Señor Lino Abad Pine, who is greatly interested in aviation. All suitable ground in this district, however, is used in rice culture and would not be available as a landing field more than six months of the year.

The Municipal Presidente requested that several planes land at Mangatarem the date of their annual Fiesta, April 30. Owing to the roughness of the ground it was decided not to chance the breaking of a wheel or a nose-over by landing, but a three plane formation went up and gave the people an exhibition. The population of Mangatarem is estimated at twenty-six thousand, and from the appearance of the crowd from the air it is thought that there were no absentees.

New French Armored Plane

A twin-engined armored aeroplane, designed to protect the pilot and gunners, has recently been designed by Liore and Oliver, a French firm. The purpose of the constructors was to supply the need for an aeroplane properly armored and at the same time light and maneuverable. The power plant of this new plane are two 9-cylinder 180 h.p. LeRhone engines, mounted in a streamline nacelle on each side of the central fuselage, which is constructed entirely of duralumin and is calculated to withstand six times the normal load. A series of tubes forming warren trusses is riveted to the longerons of the fuselage.

The pilot and the gunner, who are in one compartment, are protected by steel plates 0.276 inches in thickness, riveted together. The weight of the armor alone is 661 lbs. The gunner can either remain in his gun ring or seat himself behind the pilot and take control of the machine. To facilitate this, the gun ring is mounted on slides and can be moved backward.

The engines are supplied from a main tank having a capacity of 72 gallons, mounted in the nose of the fuselage, and by two gravity tanks in the top wing. All tanks are leak-proof. There is a pump for each of the gravity tanks, and by turning a tap in the pilot's cockpit one pump can be used for supplying both tanks if the other pump is damaged. Should both pumps be put out of action, the gravity tanks contain enough fuel for half an hour's flight. Each engine is held in place by duralumin tubes attached to the interplane struts and the landing gear.

The plane has a speed at ground level of 114 m.p.h., and at 9,840 feet 108 m.p.h., with a ceiling of from 18,000 to 19,000 feet. The length of the machine is 27.2 feet, span 47.1 feet, height 11 feet and wing area 509 sq. ft. It can carry a useful load of 1,322 lbs.

With only one engine running, the machine has made a series of figure eight turns without losing altitude. In this test the full load of 1,322 lbs. was carried, and a horizontal speed of 62 m.p.h. was made.

The Swiss Air Force

The report of the work of the Swiss Air Force during the year 1920 shows that 12,380 flights were made for a total duration of 3,532 hours. In this number of flights only 8 accidents occurred. No one was injured in these accidents, but there were two deaths as the result of crashes during non-service flights. In the training of airmen in Switzerland, which included an average of 10 hours flying per month, special stress was laid on the development of safety in flying.

Airport for Tokyo

Japanese aviation authorities, it is announced, are making preparations for the establishment of an aerial port near Tokyo. This port is intended to be the first of many aerodromes to be constructed in Japan, Korea, Saghalien, etc. It is to comprise a training ground, landing place, warehouses, customs house, hospital, wireless installations, a signal tower, etc., also equipment for night flying. The fact that this air port will be placed under the control of the Imperial Japanese Aviation Bureau will serve to make it an important military asset in time of war. In time of peace, however, it will be a welcome training ground for civilian aviators who have long felt the necessity thereof.

Aeronautics in China

Excellent progress is being made on the Pekin-Shanghai air line, which consists of six sections—Pekin, Tientsin, Tsinanfu, Nanking, Hsuchow and Shanghai. Between these different stations it is contemplated establishing several landing fields. Pending the completion of the aerodromes at the above-named stations, the Aeronautical Department of China has established a School for Air Service Administration in order to provide administrators for the aerodromes. Students of the school are chosen from among the members of the Aeronautical Department and graduates of the Nanyuan School of Flying. The number of students is 30, and the courses of study which will be given them will embody only necessary and elementary knowledge in air service administration and will be finished in three months. After graduation the students will be sent to the different aerodromes.

The Nanyuan Aircraft Factory has been removed to Tsin-Ho, and 20 Avros and 24 Vimy planes have been transported to the latter place for service in connection with the Peking-Shanghai air line.

The Aeronautical Department has issued an order to the effect that the flying personnel will be subjected to a medical examination every six months. The first examination this year was held in April.

Sadi Lecointe Wins

Sadi Lecointe, the French aviator, won the aviation grand prix at Breavia, Italy, on September 5th, flying 300 kilometers (186.41 miles) in one hour, 13 minutes and 19 seconds. Lieutenant Brakpaha, of Italy, finished second in one hour, 28 minutes and 58 seconds.

French Oversea Service

It is reported that a French syndicate is now preparing to organize an oversea airship service between Marseilles and Algiers and contemplate employing on this line three of the surrendered German airships, the "Nordstern," the L72 and the LZ113. At present there is no direct air line running between Paris and Marseilles, the nearest approach to this being the service between Bordeaux, Toulouse and Montpellier. It is not to be doubted, however, that as soon as the airship service is in operation the Paris-Marseilles airplane route will be opened. As the intention is to run a night service over the sea, probably the aeroplane service from Paris will be so arranged that the machines leave in time to connect with the airship leaving Marseilles in the evening. It should then be possible for a business man to leave London about midday, and, by connecting with the other services at Paris and Marseilles, be in Algiers the next morning.

Colombia Aerial Service

The trip from Bogota to Barranquilla, a distance of nearly 900 miles, can now be made in 21 hours, when it formerly took two weeks or longer. The traveler can go by train from Bogota to Girardot, and from there he can take one of the two new hydroplanes just received by the Colombo-German Aerial Transport Co.—of a better type and greater capacity for conveying passengers than those formerly in use—which will take him down the Magdalena to Barranquilla. A weekly mail and passenger service will be established immediately.

Work has been started on the road to Enea, which will connect the town of Manizales with the aviation field to be established in that vicinity. The field will be 1,000 meters in length, and its total cost will be 50,000 pesos.

First Military School in Ecuador

A presidential decree has created in Guayas Province a military aviation school, the first in the Republic. Fifteen students will be prepared as pilots, 10 as mechanicians and 10 as mechanicians' helpers. Ten civilian pupils will also be received. Two Italian pilots are instructors.

The Condor, a new aviation field, has been opened at Eloy Alfaro, near Guayaquil. One of the aeroplanes is the gift of the Italian colony, another of the Syrian colony, and a third of the university students.



Woods Used in Aircraft

Sitka Spruce

SPRUCE is the wood "par excellence" for the construction of aircraft. It is light and has greater strength than other woods of similar weight. It is stiff, has a considerable degree of toughness, and can be worked with ease. These properties have made it the most generally used wood for wing beams and struts, and large quantities are employed for longerons, ribs and plywood.

Although there is no great difference in the strength properties of red, white and Sitka spruce, the latter species, on account of its greater size, and consequently its larger proportion of clear lumber, is a more important source of aircraft material than the other two. Because of this and the large supplies of virgin timbers still remaining. Sitka spruce will probably for many years be a very important species in the aircraft industry. The trees reach diameters of from 12 to 15 feet and heights up to 200 feet. Average mature trees are between 4 and 6 feet in diameter and contain from 10 to 15 thousand feet of lumber.

Eastern Spruce

Eastern spruce is also known as red spruce or white spruce. Its use is ideal for the structural parts of aircraft, because in them lightness and ease of working are combined with great strength, stiffness and freedom from hidden defects. The three species do not differ greatly in strength properties, but Sitka spruce produces a larger proportion of clear lumber suitable for aircraft work.

Spruce is used for almost every wooden part of aircraft. Even though its place may be taken to some extent by other woods as the supply of virgin spruce dwindles, it will undoubtedly continue to be a very important aircraft material so long as wood is used for these purposes.

The northeastern spruce does not reach large size. While diameters of from 2 to 3 feet are not uncommon, a great many of the trees in mature areas have diameters between 12 and 18 inches.

Douglas Fir

This species is also known as red fir, yellow fir, Oregon pine, red pine and Douglas spruce.

Douglas fir is a very satisfactory substitute for spruce in making wing beams, longerons, struts and engine bearers, and has been so used to a considerable extent. While somewhat heavier than spruce and more liable to "check" and "shake" during manufacture and in service, in its strength properties it is equal or superior to spruce of the same sizes. The enormous supply available, the large proportion of high grade material, and the high degree reached by the lumber industry in the Douglas firm region, make this species an important source of aeroplane material.

The trees average from 3 to 6 feet in diameter and from 150 to 200 feet in height and many are much larger.

Port Orford Cedar

This species is also known as Lawson cypress, Oregon cedar and white cedar.

While somewhat heavier than Sitka spruce, Port Orford cedar is equal or superior to spruce in all its strength properties. It has been used successfully as a substitute for spruce in making parts where spruce is usually employed.

While this species is satisfactory for aircraft use, the limited supply and small annual output indicate that it will probably not play a very important part of the future development of the aeroplane industry. Trees of this species reach very large size.

Fir

Fir is known by a number of different names. Grand Fir is also known as lowland white fir, white fir, Oregon white fir and silver fir. Silver Fir is also known as lovely fir, amabilis fir, red fir, red silver fir and larch. Noble Fir is also known as larch and red fir. White Fir is also known as California white fir, balsam, and silver fir.

Grand fir is somewhat heavier than spruce and about as strong. Silver fir is also slightly heavier than spruce but practically equal to it in most of its strength properties. Noble fir is as strong as spruce but lighter in weight. White fir is a little lighter than spruce and almost as strong except in shock resistance.

While the firs have not so far been used to any extent in aeroplane construction the first three species named may be substituted for spruce in making wing beams and struts. The other firs are not strong enough for such use, but because of their light weight are suitable for core work in making ply wood.

White Pine

This species is also known as Weymouth pine, Northern pine, spruce pine and soft pine.

White pine, although somewhat softer, less shock resistant, and less stiff than spruce, is comparatively strong and light, uniform in structure, easy to dry and work, and stays in place well. It is a fairly satisfactory substitute for spruce and because of its lightness makes excellent cores for ply wood. Norway (or red) pine may also be used as a spruce substitute.

The remaining supply of virgin white pine is fast disappearing; and, since very little wing beam material can be obtained from second growth, this species will not long continue to be an important aircraft material except possibly for ply wood. White pines average 3 feet and more in diameter and 100 feet or more in height.

Western White Pine

This species is also known as Idaho white pine, mountain pine and silver pine. Western white pine is slightly heavier than spruce but compares very well with it in all properties except hardness. Because of the relatively small percentage of the cut that is available for aeroplane use, and because of the abundance of other woods suitable for the same purpose, it is very likely that western white pine under normal conditions will not be a very important source of material for the manufacture of aircraft.

Sugar Pine

Sugar pine is low in shock resisting ability and in the quality of stiffness. It varies widely in the strength properties and is therefore not well adapted for parts of aircraft where great strength is a requisite.

Being soft, light, and easy to work, it may be used in less critical parts, particularly for ply wood cores. Since, however, other species cut for wing beams will yield a large supply suitable small sized material, sugar pine may never become very important for aeroplane uses.

Western Hemlock

This species is also known as Prince Albert's fir and Alaska pine.

Western hemlock is low in shock resistance, heavier than spruce, but lighter than Douglas fir. It might be used as a substitute for spruce but it will be useful only to a limited extent so long as supplies of better material are available. It makes a satisfactory ply wood core and may sometimes be of considerable importance for this purpose since the supply is large and the wood comparatively cheap.

Red Wood

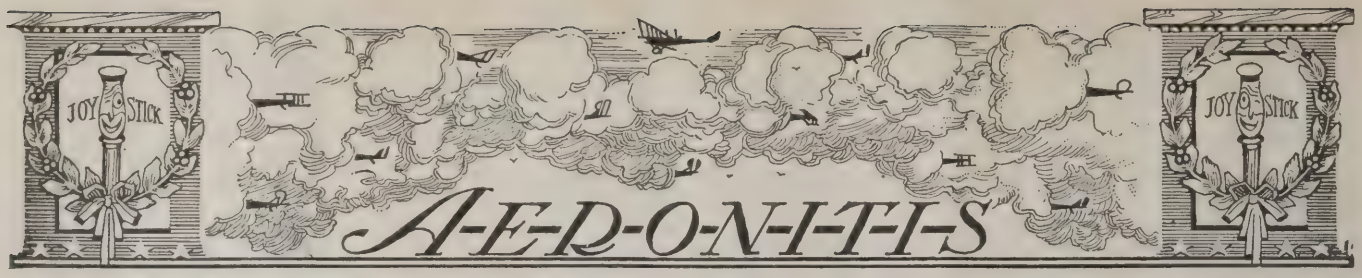
Red wood and "Bigtree" are variable in their properties and not suitable as a substitute for spruce. On account of its lightness it is good for ply wood cores. This material is easily worked.

Bald Cypress

This species is also known as cypress, swamp cypress, southern cypress, black cypress, red cypress and white cypress.

Cypress is slightly heavier than spruce. Carefully selected pieces are somewhat superior in strength to spruce when used in the same sizes. It is greatly variable in its strength properties, however, and selection of suitable pieces is difficult on that account. Furthermore, satisfactory methods of drying and gluing have not yet been developed. Until these difficulties are overcome it will probably not be a popular wood for aircraft use.

(To be Continued)



A Family Model

North: "When I saw Charley a year ago he was just about to buy a two-passenger runabout. Did he get it?"
West: "No. He got married and bought a one-passenger pushabout."—*Judge.*

The Luck of Ananias

Sunday school teacher asked a small girl the other day why Ananias was so severely punished. The little one thought a minute, then answered: "Please, teacher, they weren't so used to lying in those days."—*London Post.*

Ethel: "You can't judge a man by the way he dresses."
Mary: "Oh, I don't know. I can tell a gentleman by his get-up in a crowded street car!"—*Judge.*

"How do you like my new dress, Dad?"
"I don't think much of it as a dress. As a hosiery ad, it's fine."

Teacher: "What would you do in the case of someone drowning?"
Student Life-saver: "Bury him, of course."

Inquiry Officer: "Were you ever married?"
Would-be Soldier: "Yes sir."
Inquiry Officer: "Whom?"
Would-be Soldier: "A woman."
Inquiry Officer: "Did you ever hear of anyone marrying a man?" (this sarcastically).
Would-be Soldier: (brightening) "Yes, my sister did."

Just Like a Man

Gladys: "Did your husband take you to the baseball game?"
Mae: "Yes. I wish he'd talk to our cook like he did to the umpire."

Stunt Aviator: "Behold me, in the flower of manhood."
She: "Yes, a blooming idiot."

Mechanic: "My brother takes up Spanish, Greek, French, Italian and German."
Pilot: "Z'at so? Army or school, son?"
Mechanic: "Nope. He runs an elevator."

Shocking

Mary had a little dress,
She wore it very high;
And everybody turned and stared,
When she came passing by.

He: "Does your dad object to kissing?"
She: "I don't know. Did you want to kiss him?"

Mechanic: "Say, Colonel, we mechanics demand shorter hours."
Colonel: "Really, old chap, I can't do a thing about it. Better go to Father Time."

Apologies to Longfellow

I shot an arrow into the air,
It fell to earth I knew not where,
Until one day with rage profound,
The man it fell on came around.
In less time than it takes to tell,
He showed me where that arrow fell
And now, I do not greatly care
To shoot more arrows into the air.

E. A. M. D., Jackson, Michigan.

I

When Homer smote his blooming lyre,
He smote his way to fame;
But many hundred simple souls
Have never heard his name.

II

When Babe Ruth smites the blooming ball,
And smites it o'er the fence,
His "Homer" makes the Grecian one
Resemble thirty cents!

Prof.: "What is the chief state of Mexico?"
Stude.: "Turmoil."

Good Advice

One should say "nay" in a "horse" whisper.



Aerial Transportation in 1930

A

OCT 3 1921

AERIAL AGE WEEKLY

VOL 14, No. 4 OCTOBER 3, 1921 10 CENTS A COPY



Airscape of Pensacola's Lower Business District with the Plaza Ferdinand Seventh in the Center. It was on This Plaza that General Andrew Jackson Took Over Florida from Spain for the United States in 1821

German Experimenters and Soaring Flight

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
scriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



The

Loening Flying Yacht!

A RIGIDLY braced monoplane of the type originated by Grover C. Loening, and adopted by the U. S. Government, translated into a comfortable five-seater commercial flying boat.

The manner in which the strength of this machine has been obtained, with the unusually light weight, is the keynote of its advanced refinement in design.

The wing structure is practically identical with that of the most recent U. S. Army Loening Monoplanes, which in official sand load test demonstrated a safety factor of over nine. The double fin and rudder tail structure insures a torsional strength far in excess of that previously obtained in flying boats.

The simple hull has a double strength, since the interior is completely cross braced by wires and trussing to take the tail load as a fuselage, without regard to the additional strength of the sides and bottom.

The high performances in speed range and climb follow from the neat, simple design—a high speed of 135 miles per hour, with a slow speed of 55 miles per hour, and a climb of 10,000 feet in 10 minutes.

The remarkable accessibility and ease of maintenance have developed from a very thorough study of practical requirements.

During the last few weeks the first machine of this type has been flown constantly several thousand miles, and a careful measurement of fuel consumption, on long trips, has shown that at a cruising speed of about 120 miles per hour 20 gallons of gasoline are used, which gives the remarkable economy for a fast airplane of 6 miles to the gallon, carrying 4 passengers.

LOENING AERONAUTICAL ENGINEERING CORPORATION

351-355 WEST 52nd STREET, NEW YORK CITY

Cable Address: "Monoplane" New York Telephone: Circle 6070

October 3, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 4

TABLE OF CONTENTS

German Experimenters and Soaring Flight 75
International Air Laws..... 75
The News of the Week..... 76
The Aircraft Trade Review..... 78
Standardization and Aerodynamics.. 79
Seal Hunting by Air..... 80
Performance of a Vane-Driven Gear Pump 81
Aero Club of Pennsylvania 84
Naval and Military Aeronautics.... 85
Foreign News 86
Elementary Aeronautics and Model Notes 87
Aeronitis 88

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

AIR LAIRD PLANES WICHITA-KANSAS

The Laird Swallow
"America's First Commercial Airplane"

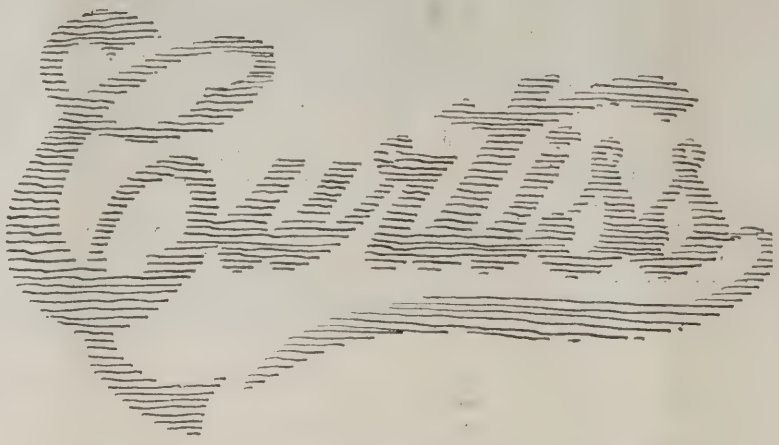
NOW $4,500 F. O. B. WICHITA, KAN.

INCREASED production enables us to announce this reduction, effective immediately. At this price the Laird Swallow will be the most wonderful buy in America today. Brand new in every detail—built in our own factory, powered with the OX5 motor, carrying three passengers with full load of fuel and baggage—magnificent in performance—remarkably low upkeep and operation costs.

Our new sales plan will be most interesting to every person interested in aviation. Write for details and booklet.

E. M. LAIRD COMPANY
Manufacturers
WICHITA, KANSAS
General Sales Offices
2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.,
2216 So. Michigan Ave., Chicago, Ill.
Please send me details of your new sales plan and copy of booklet.
Name .....
Address .....
.....
AA



A Further Reduction

APPROXIMATING 25%

in the price lists of parts

for

Orioles
O X Standards

Jennies
C 6 Standards

is announced

EFFECTIVE SEPTEMBER FIRST

Write for revised price lists.

Motor price lists are not affected in this reduction.

CURTISS
AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLOUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., October 3, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, OCTOBER 3, 1921 NO. 4

German Experimenters and Soaring Flight

THE terms of the Peace Treaty debarred Germany from conducting experiments with full-powered aircraft, and they have filled the gap by conducting trials with gliders with really notable results.

F. Handley Page, the well-known British constructor, recently visited Germany, where he was greatly impressed with this work. He confirms the belief that the German study of this branch of aeronautics is a serious scientific undertaking and points out that the leading German aeronautical scientists, such as Prof. Prandtl of Göttingen, take a deep interest in the tests, and that a number of machines entered have been built under the superintendence of professors of German technical institutes by the students attending those institutes.

The serious nature of the study arises in two directions. In the first place such tests allow of full-scale research being carried on extremely cheap.

The actual gliders, cost little to build—certainly much less than a respectable wind channel, and allow of the making of tests of control, stability and aerodynamic qualities under convincing conditions.

Secondly the soaring tests give opportunities for the investigation of the structure of the atmosphere. This may and should have a direct value for purposes other than that of soaring. Also it is likely to lead comparatively quickly to an understanding of the exact conditions under which soaring is practically possible.

The Wasserkruppe, which is the scene of these trials, is a hill 900 odd metres high (3,000 ft.) in country bare of trees and free of obstructions in all directions. With a wind in any direction, of any appreciable strength, soaring appears to be possible, and up to the present glides of up to 5½ minutes' duration, and of a maximum of nearly five miles in length, have been achieved therefrom. An appreciable element of soaring enters into such flights.

Mr. Page himself witnessed a flight made by Professor Klempferer of the Aachen Technical School in a wind of about 25 m.p.h. The machine used was the Aachen cantilever monoplane. The machine was launched by a crew of about eight men. Two of these held the wing tips, while three were at each end of a long rope passed round the heel of the skids of the machine. This rope had at its end lengths of rubber shock absorbers.

The men at the end of the rope walked forward till the rubbers were fully extended. Then on the pilot's signal the men at the wing tips let go, and those on the rope again walked forward. The machine started to slide over the ground, at the end of two metres was in the air, and within a second was thirty feet up. Moving forward over the ground at a very slow speed, the pilot (Professor Klempferer) proceeded to climb, in a series of steps, corresponding to wind gusts, till he had reached a height of some 100 to 180 feet above starting point.

As the wind at the time was in an unsuitable direction, blowing across from the top of an adjacent peak, the machine soon ran into the down current on the lee of this peak, and descended, landing in the intervening valley.

Mr. Page expresses himself as greatly impressed by the care, ability and ingenuity displayed in the design of some of the gliders, and seems to concur in the German view that they will shortly have learnt enough about the possibilities of soaring flight to build practical auxiliary engined soarers whereon quite extended flights will be possible.

International Air Laws

THE International Law Association has been holding a series of meetings at the Hague recently, for the discussion of various subjects related to intercourse between nations. How far these discussions are of an official nature, or whether the decisions of the Association have any binding effect on the nations represented, we do not altogether know. As a matter of fact, we believe the discussions are altogether academic and are principally interesting as an indication of the way matters affecting international relations are regarded from the standpoint of the legal mind.

Among other things, the Association has apparently been engaged in the discussion of international aerial law, and has come to the conclusion that the Aerial Convention of 1919 should be ratified by the signatories as soon as possible, and that all the other countries of the world should adhere to it and pass laws accordingly at the earliest possible moment.

The News of the Week

Colonel Patrick Nominated as Air Service Chief

Washington. — Col. Mason Mathews Patrick of the Corps of Engineers was nominated September 21 by President Harding to be chief of the air service, with the rank of Major-General.

The nomination of Col. Patrick, who served as chief of American expeditionary air service, did not come as a surprise in army circles, as his name had been mentioned continuously since it became known that Major-Gen. Menoher had asked to be released as head of the air service. In order that Secretary Weeks might have a free hand in reorganizing that branch of the army Brig.-Gen. Mitchell, assistant chief, presented his resignation also, but Mr. Weeks said that he had agreed to withdraw it and remain as assistant chief, at least for the present.

Col. Patrick is a native of West Virginia, and was appointed from that State to the Military Academy in 1882. During the war he was first appointed a Brigadier General of the National Army and served in that rank as Chief Engineer, Service and Supply, American Expeditionary Forces, in charge of the gigantic construction program in the supply zones in France. Later, when difficulty arose with the air program of the expeditionary forces, he was selected by Gen. Pershing as chief of the air service, and in that capacity served during the remainder of the war. On his return to the United States he was assigned to duty as commander of the engineer camp at Camp Humphrey, where he is now on duty.

Secretary Weeks said recently that Col. Patrick's services as chief of the air service in France had been of a very high quality and the War Secretary warmly commended the officer's capacity for organization, even before it was known that Col. Patrick was to be named to succeed Major-Gen. Menoher.

Gen. Menoher, who commanded the forty-second (Rainbow) Division throughout its entire fighting career in France will be given his choice of the three corps area commands that will be vacant in the near future.

Swiss Aeronaut Wins Gordon Bennett Cup

London.—With the landing of the Swiss balloon Sept. 20, piloted by Capt. Paul Armbruster, all the fourteen competitors in the international race for the James Gordon Bennett trophy, which started at Brussels, Belgium had been accounted for.

The Swiss entrant landed at Lamby Island, off the east coast of County Dublin, Ireland, and therefore wins the cup.

According to unofficial estimates Ralph Upson, the American pilot in the Belgica I., loaned him at the last moment by Capt. De Muyster and Henry Spencer, an English entry, have apparently tied for second place, their balloons landing close to each other near Carnarvon, Wales. The French balloons Marne and Picardy landed near Dolgelly, in North Wales.

Another Stuntster Killed

Oklahoma City. — Lieutenant Arthur Emerson was killed here Sept. 24 while attempting to change from one aeroplane to another at the State Fair Grounds. Six thousand persons saw him fall 200 feet.

L. C. Brand Makes Unique Trip

Another achievement for the Liberty motor was recorded, when L. C. Brand's Liberty motored Le Pere made a round trip to Mono Lake, Mono County, California from Los Angeles recently. This was the first time any aircraft had ever landed in Mono County.

The field was 7000 feet high, right in the heart of the old Sierras, bordering on Mono Lake. The location is about due east of Yosemite, in that part of the country to which people come from great distances to take part in the yearly trout fishing, which is supposed to be the best in the country.

Mr. Brand is a wealthy aeroplane enthusiast, owning two late type aeroplanes, and who does not believe in keeping them idle. The flight was made from Los Angeles, by way of Mohave and Bishop, Calif., with a landing at Little Lake for fuel. The up trip was made in two hours and fifty-two minutes flying time, and the return trip in three hours flat. When one considers that by automobile it is a day and a half journey, the short jump by aeroplane is the only logical way to get there.

The flight was made without incident, no rough air was encountered, and the Liberty motor never missed a shot. G. G. Budwig, who originally tested the machine for its constructors, was the pilot. Mr. L. C. Brand and F. W. Pomeroy were the passengers, and the old timers at Mono Lake still cannot get over the fact that the party had breakfast in Los Angeles, and lunch at Mono Lake.

District of Columbia Considers Air Traffic Control

District and police officials differed at their meeting September 15, as to the regulation of aeroplane traffic in the District of Columbia, recommended for the first time in the annual report of Superintendent of Police Gessford.

In the absence of Major Gessford, who is now on his vacation, speculation was rife as to the best means of patroling the air. An act of Congress will be necessary to regulate altitude of planes, and examinations of machines and operators.

Assistant Superintendent of Police Charles Evans said some police officials claimed that aeroplanes are included in the traffic regulation providing that drivers of motor vehicles must have permits.

Safety of the machines could be ascertained at the time of application for the driver's permit, and revocation of permits of offending fliers would break up dangerously low flying, it was contended.

Planes should be kept 1,000 feet from the ground, in the belief of some District officials, who cited cases of machines coming within ten yards of Pennsylvania avenue during parades, endangering not only their own but the lives of spectators.

Establishment of an air traffic bureau, with a corps of airmen and plane equipment, would be needed for the enforcement of the law, it was pointed out.

Roosevelt on Air Trip to Address Veterans

Camp Edwards, N. J.—Theodore Roosevelt, Assistant Secretary of the Navy, reached here September 15 by aeroplane from Washington and delivered an address to the State convention of the American Legion of New Jersey. Mr. Roosevelt flew from Washington in three hours in a plane piloted by Lieut. Ford O. Rogers of the Marine Corps and returned in the same machine.



The Siddeley "Sinaia," one of the latest machines designed for the British Air Ministry by the Armstrong Whitworth Aircraft, Ltd. The long tail appended to each engine nacelle is of interest. The guns in these nacelles, combined with the forward gun ring in the fuselage nose should give an almost complete absence of "blind spots." Photo courtesy "The Aeroplane"

Aerial Program at Kansas City Legion Convention

Interest in the American Legion Convention at Kansas City centers in the Flying Club's aerial circus and derby program of eleven events, which is designed not only to entertain the vast crowds, but also to demonstrate the progress of aviation since the close of the war. There will be cash prizes of $10,000 and $10,000 in cups.

On the outskirts of the city, a 90-acre field has been leveled off and arranged for the flying meet. All details are in the hands of men experienced in aviation,—the sixty members of the Flying Club all having served in the army, naval or marine branches of the air service during the World War.

Oil and fuel will be furnished free to contestants. Full facilities will be available for the repair of machines and motors, a complete machine and plane repair shop having been erected on the field.

To date, the entry list includes many of the notable aces and leading civilian flying instructors of the war, in addition to famous pilots now employed by the prominent aeroplane manufacturers and leading stunt and commercial flyers.

Planes of every type have been entered in the meet. From Europe will come several ships made famous in the war. Everything known to the aerial game—the entire gamut from stunts to speed tests—is included in the eleven events on November 1 and 2. The meet will open with a spectacular air raid over Kansas City the night of October 31. Flares dropped from planes playing in the powerful rays of a battery of the largest electric searchlights in the world will characterize the raid.

A feature of the program for November 1 will be a parachute leaping contest for women. The present record of 15,500 feet has been bettered twice recently by two women practicing here for the contest.

Entries for the meet will not be closed until the first event is called by the field marshal. The Flying Club is receiving entries at its offices, 126 Hotel Baltimore, Kansas City.

The list of events and prizes for the flying meet follows:

Event No. 1

(a) Altitude Test. World's Record. Single Seater. $250.00 cup to machine reaching highest altitude.

(b) Altitude Test. World's Record. Two Seaters. $250.00 cup to machine reaching highest altitude.

(c) Parachute Altitude Test. For Men World's Record. $250.00 cup to jumper from highest altitude.

(d) Parachute Altitude Test. For Women World's Record. $250.00 cup to jumper from highest altitude.

Event No. 2

Formation flying by army and civilian planes.

Event No. 3

Parachute drop from captive balloon by a woman.

Event No. 4

Exhibition of plane changing, wing walking and standing on top of wing while plane loops, together with Parachute drop from captive balloon and planes at an altitude of 2,000 feet.

Event No. 5

Stunting contest. Three best planes will be picked for finals to be held on the following day. Absolutely no stunting to be done under an altitude of 1,000 feet. $600.00 Silver Cup for first place.

Event No. 6

Exhibition of Sport Model planes. Planes take off singly, each ship to be in the air seven (7) minutes. They may perform any stunts above 1,000 feet with a view of showing quickness of climb, manoeuvre ability and speed, and finally, landing in the smallest possible distance. Prize $500.00 Silver Cup to winner.

Event No. 7

Relay Race. Entries open only to JN4D's and Canucks, or ships of the same type. Four planes to a team. Entry list limited to five teams. Teams will race from a standing start once around a 15-mile triangular course, 5-miles between corners. Each ship will land back on the field, taxi to the line of start, whereupon the second ship will take off. Prizes to the winning team, $250.00 to each pilot in cash; second place $125.00 to each pilot, total $1500.

Event No. 8

The Legion Junior Derby. Open to all ships of less than 100 miles per hour air speed. The race will be five times around a triangular course of 15 miles; 75 miles in all. Prizes of a large silver cup valued at $1250.00 to be awarded by the President of the United States in addition to cash prizes of $1000.00 for first, $500.00 for second, $200.00 for third, and $100.00 for fourth place.

Event No. 9

Looping Contest for World's Record. No loops under 1,000 feet. $500.00 Silver Cup to the Winner.

Event No. 10

For passenger carrying ships of 5 passengers or more. This is to cover freight, express and mail planes. Planes are to be judged on all-around efficiency. Rules to be designed to develop the efficiency and practicability of the plane as a transportation unit. An efficiency trophy valued at $500.00 will be given the winning ship.

Event No. 11

The Legion Derby. Open to any make of plane, horsepower, or wing spread. Machines to start at scratch, race over a triangular course of 5 miles, 30 laps or 150 miles in all. Prize one leg on a cup costing $2500.00. This must be won twice to become the permanent property of the winner. Another beautiful cup, valued at $1200.00, will be awarded the winner of first place, as his permanent property. These prizes will be presented by the President of the United States on the floor of the Convention Hall. In addition, cash prizes of $3000.00 are offered for first, $2000.00 for second, and $1000.00 for third place.



Colonel Mason M. Patrick, who has been nominated as Chief of the Army Air Service

"Flying Matinees" in England

"Flying Matinees" have always been one of the hardships of the stage business, but now Philip M. Faraday, manager of the Duke of York's Theatre here, promises to put thrills into them with real flying. He will take a company by air to Manchester for a matinee performance at the Hippodrome of "The Wrong Number." After the matinee the company will fly back to London for an evening performance in the Duke of York's Theatre. The distance between London and Manchester is 183 miles. Arrangements for the trip have been completed by the Handley Page company.

Here is the schedule: 8 A. M.—Leave the Duke of York's Theatre. 9 A. M.—Leave Cricklewood airdrome. 11:30 A. M—Arrive Manchester. 12 Noon—luncheon. 1:45 P. M.—Curtain rises. 3:50 P. M.—Performance ends. 4:05 P. M.—Leave Manchester airdrome. 7 P. M.—Arrive London. 7:30 P. M.—Dinner. 8:45 P. M.—Curtain rises at the Duke of York's Theatre.

The company, which numbers fourteen persons, will take their costumes and makeup with them, and returning to London they will have to change from their costumes and remove their makeup while in the air.

World's Board Progresses

The World's Board of Aeronautical Commissioners, Inc., now consists of 98 commissioners in 81 countries and colonies of the world, and when the list is completed, there will be over 125 commissioners in about 100 countries and colonies.

The officers state that in the United States prominent and influential business men are accepting the position of chairman of the board for the state, county and city in which they reside. To date the acceptances indicate that when the organization is completed there will be 48 state chairmen, 2,800 sectional chairmen, 12,000 local chairmen.

The local chairman will have charge of a campaign for members, and if each one secured ten members, it will make the membership in the United States over 100,000.

The above plan carried out throughout the world would make a working staff of 100,000, and should produce 1,000,000 members.

The officers of the organization anticipate that they will be in a position to offer cash prizes to advance aeronautics and encourage the use of aircraft, and that when the people become interested in aeronautics there is every reason to believe the use of aircraft would increase at a wonderful pace as did the automobile following the running of the "Glidden Touring Contests" which interested the people in the automobile, created a great demand for motor cars and did much to cause the building of good roads.

The AIRCRAFT TRADE REVIEW

Lubrication Engineers to Meet

The American Society of Lubrication Engineers will hold its first Annual Convention, in Chicago, on October thirteenth and fourteenth, 1921.

Special effort is being put forward by the officials of the society to assure those who attend a splendid program. A number of eminent authorities will read papers. A number of the largest manufacturing plants and oil refineries have issued invitations to visit and inspect their works.

This society was established to promote a better understanding of the problems of lubrication and the use of liquid fuel oil including all of the problems of application and conservation. As the main endeavor is to interest those whose lives are partly if not wholly coming in contact with these problems, the Convention will be open not only to members of the society, but to all interested in the work.

Something New In Balloon Piloting

An ingenious mechanism constructed by a former Captain of the Air Service, R. C. Pierce, now a Consulting Engineer, at 30 East 42d Street, New York City, is believed to be the first instance in which a "Propaganda Distributing Device" that will automatically pilot free balloons has been developed. The work was done for the Air Service, McCook Field, Dayton, Ohio.

The mechanism is really a combination of two inter-functioning automatic devices, and is intended for the distribution of printed matter, manufacturers' samples and other objects, including the dropping of small bombs, from free balloons. Incorporated in the mechanism is a special provision for arresting the descent of the balloon by the automatic release of sufficient ballast to restore the required degree of buoyancy to maintain practically a fixed elevation.

The first effort of any magnitude to distribute propaganda from the air occurred during the war, when aeroplanes were employed for the purpose; but the losses sustained were so heavy that the attempts were largely abandoned. This led to experiments with spherical balloons, owing to the fact that their path through the air can be forecast with comparative accuracy. The method of distribution was fairly successful but long flights were not possible as balloons without pilots or ballast throwing devices would soon come to earth.

The Pierce Propaganda Device weighs 35 pounds, and is capable of carrying a useful load of 80 pounds. The device is attached to a 300 feet suspension cord close to the balloon, the cord trailing below like a drag line. Attachment to the cord is by friction rollers, which grip the cord and can turn only by rolling down its course. The rate of descent of the device along the cord is controlled by a small centrifugal governor. The device thus furnishes its own power much as in the case of the familiar "monkey on a cord" toy of our childhood days.

Turning with the rollers are shafts, threaded right and left, on which is hung the material to be distributed. If this is printed matter holes are punched at one end of the sheets. Rotation of the shafts causes the paper to feed off the ends and down through slots in the bottom of the waterproof cover of the device. Ordinarily twenty sheets per minute will be fed off in this manner, at which rate eight hours are required to distribute a full load of propaganda and bring the device to the end of the suspension cord.

The automatic pilot consists of a tight case containing what, to all intents and purposes, is a small gas holder. An increase of atmospheric pressure on descending will force the ball downward, closing an electrical circuit, current being furnished by dry cells. This throws in a clutch, causing a ballast shaft, having a coarse right and left hand thread, and carrying printed matter, to rotate one revolution and then stop. In this revolution sufficient ballast is released to check the descent. The electrical contact also opens a magnetic valve and restores the pressure equilibrium within the automatic pilot, and the device is reset for the next attempt of the balloon to descend. The time required to actuate the device is less than one second, and it is sensitive to descents of less than forty feet.

Provision is made to start feeding the propaganda at any desired time after the balloon leaves the ground, and also to destroy the device when all propaganda has been distributed. With this device printed matter may be distributed at little more than postage rates.

New York-Cuba Line Inaugurated

A new bi-monthly aerial transportation service between this city and Havana was inaugurated when the flying boat Presidente Zayes left the airport at Eighty-second Street and North River with four passengers on board. The passengers were Miss Dona Mobley and Miss Gladys Carruthers, of this city, and L. Lopez de Haro and Alegario Monteo, two wealthy sportsmen of Havana.

The new flying boat, which is one of the fleet operated by the Aeromarine Airways, was piloted by D. G. Richardson and Richard Greisinger. It will make two stops during the 1,400-mile flight and will not do any night flying.

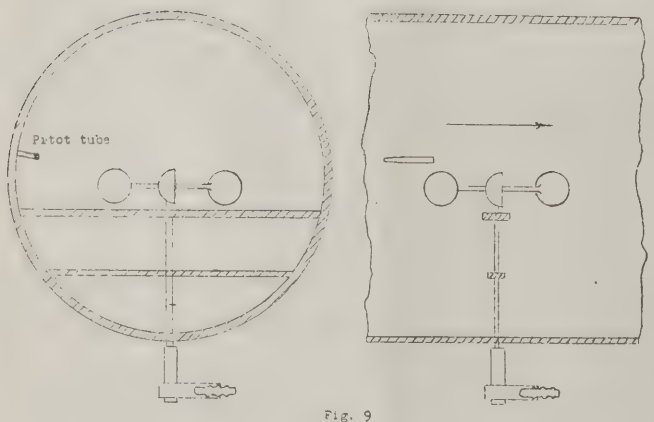


Fig. 9

Performance of a Vane-Driven Gear Pump
(See page 81)

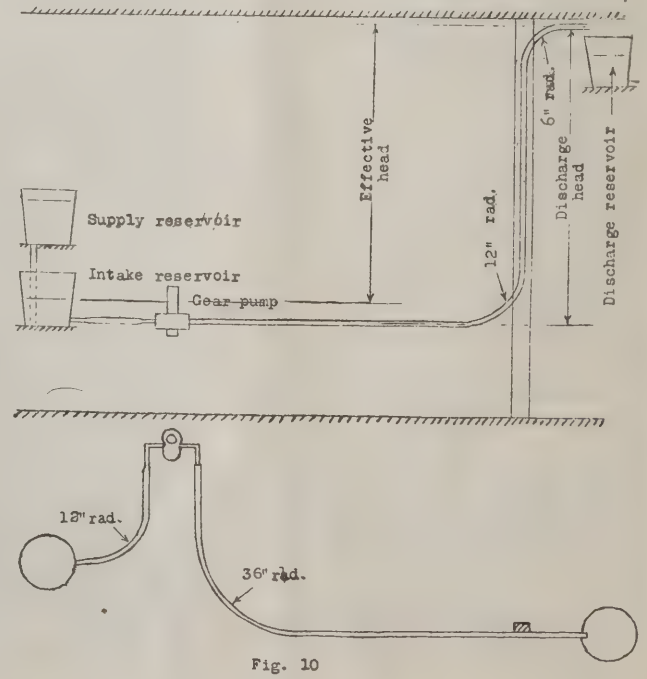


Fig. 10

STANDARDIZATION AND AERODYNAMICS

By PROF. L. PRANDTL

Head of the Aerodynamical Laboratory, Göttingen University
With an Introductory Note by William Knight

Introductory Note

IN the last June 20 issue of the AERIAL AGE I pointed out the desirability of reaching some sort of agreement between the various research aerodynamical laboratories and other scientific aeronautical organizations both in this country and abroad about the symbols, graphical methods and other means of representation used in technical and scientific aeronautical publications giving the results of the research work done by the various investigating aeronautical agencies in the United States and in Europe.

Such work is useful only if the results obtained in the laboratories are presented under such a form as to allow to be readily used by aircraft designers and constructors and by students of aeronautics. At the present time there is such a confusion of symbols, terms and meaning of graphical methods used by the various aeronautical research agencies in the world and such a lack of well organized co-operation among the leading aeronautical laboratories that it is no wonder that aircraft designers, engineers, contractors and students of aerodynamics fail to benefit to the fullest extent of the excellent work which has been done and is being done by the various aerodynamical research laboratories in the United States and in Europe. The results of such a state of affairs are a waste of energy and a consequent retard in the progress of aeronautics.

A remedy to these unfortunate prevailing conditions could be worked out if a leading scientific research organization in this country as, for instance, the Bureau of Standards or the National Advsiory Committee for Aeronautics should take the initiative in suggesting to the various aerodynamical laboratories and other scientific aeronautical research organizations both in the U. S. and in Europe the adoption of the same symbols and the same terms for expressing the same thing everywhere; in other words, applying standardization to aerodynamical works.

An agreement could easily be reached because the importance of reaching an agreement is very badly felt by every student of aerodynamics. All that is needed is to have a leading scientific aeronautical organization posing the problem and to invite a free discussion of the various standards used by the various European nations and by ourselves. From the discussion, which can take place by correspondence, a common ground of agreement can be found and after such an agreement has been reached an international conference between the representatives of the various organizations which have discussed the matter can be called and the adoption of international standards on aerodynamics can be decided upon. Also a function of this international conference should be to devise a means of bringing about a much desired closer co-operation between the various research laboratories so as to present as much as possible the dispersion of good efforts.

The National Advisory Committee for Aeronautics or the Bureau of Standards are the best suited for taking the lead in such a vitally important matter because, fortunately enough, we are free from post-war hatred and we would not be inclined to discriminate between scientists of formerly allied nations and scientists of formerly enemy nations as might probably be the case if the lead in this matter should be taken by some European aeronautical organization under government control.

I know for a fact that American leadership in this matter would be greatly welcomed by everybody in Europe interested in the scientific progress of aeronautics and by making such a step we would greatly contribute to such a progress.

In the meantime, while eagerly waiting for something being done in the direction pointed out above, I have taken up the matter with leading aerodynamical research workers and I have asked them to express their views on the subject of "Standardization and Aerodynamics."

The following paper from Professor L. Prandtl of Göttingen, Germany, who has contributed to a very large extent to the present knowledge of aerodynamics is published with his kind permission. The point of view of other European leading aerodynamical research workers will be published later for the purpose of showing that all of them have useful suggestions to make and that all that is needed to bring about results is to take the lead in bringing them together and letting them decide something which will be agreeable to everybody and especially to manufacturers and designers of aircraft who are the only ones for whom the reseach work is done in the laboratories and books and for whom technical reviews are published.

PROF. PRANDTL'S COMMENT

1. *The Wind Tunnel.*

In order to accomplish any comparative results in wind tunnel tests it is of prime importance to have *the air currents comparable.* This of necessity calls not only for an accurate air current at the place, where the test is to be made in size as well as direction, but that the wind eddies are kept at a minimum. In the Göttingen Laboratory this was one of the main requirements. Fig. 1 shows an easy way to obtain an air current with minimum wind eddies quieted as much as possible in a great profile through a honeycomb and then contracted in a much smaller cross section. The tests are made on the place marked Exp. Fig 1.

I maintain that this arrangement is very important and firmly believe that only this or any equivalent arrangement will give comparative results. It is of less importance, whether the wind tunnel has closed circulation, or whether a tunnel with suction blast is used, and whether the measurements are made in a free air current or between stationary walls. In regard to horizontal bouyancy the free air curernt, as first introduced by Eiffel, is in my opinion to be preferred. Through special formation of the outlet the velocity can be made constant even at a short distance from the mouth of the outlet surface. Through determination of the drag of a big ball the wind eddies of the air current are accurately determined. As known, below a critical velocity the drift coefficient is approximately 0.24, above this critical velocity about 0.10. The critical velocity—the critical $\frac{VL}{\nu}$ —is that much smaller as the eddy is greater. The Göttingen measurements correspond very much to the Italian measurements, where

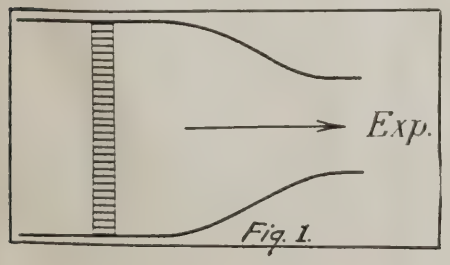


Fig. 1.

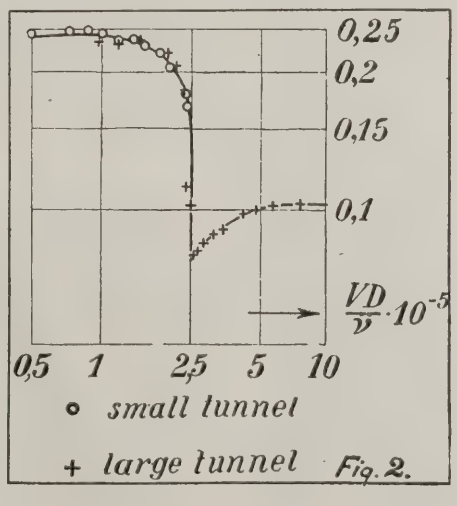


Fig. 2.

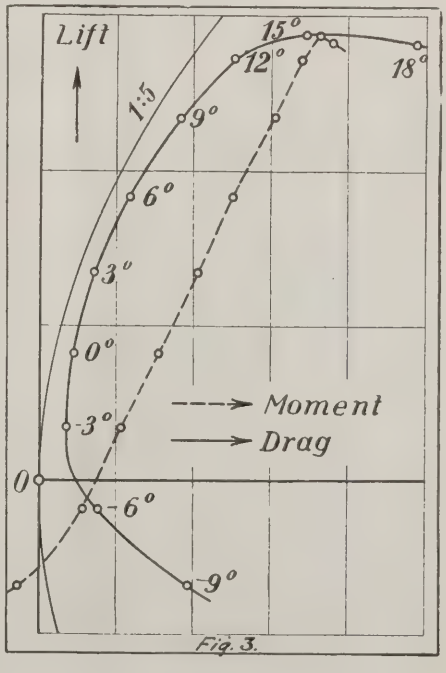


Fig. 3.

a ball was dragged through calm waters. And the conclusion can be drawn that the small wind eddies here in Göttingen do not change the results very much. As example of the agreement between measurements with different wind tunnels, which are constructed on the same principle, I give in Fig. 2 the results of two measurements with balls, one with a ball 28 cm diameter in the great wind tunnel (4 m²), the other with a ball 20 cm diameter in the small tunnel (1.2 m²). The almost perfect agreement of both series can be noticed.

2. *Size of models and Air Velocity.*

For approximately correct agreements of model measurements with actual conditions, it is important not to select models and also the air velocities too small for the measurements. In the Göttingen measurements a span of from 1 to 1.2 m. and a wind velocity of 30 M/sec. gave the best results. Even in this ratio the agreement is not perfect, although it is comparatively safe to have the deviations not very great. The modern wind theory allows a calculation of the influences exerted by the walls of the test tunnel or by the limitations of the free air stream. And if this correction is taken into consideration one can safely with the span of the models go even a little beyond half of the air current diameter.

3. *Placing of the Models.*

The manner in which the model is fastened during the test is of greater influence than at first suspected. The difference between the Eiffel results and the N.P.L. results at Teddington is easily accounted for. By the Eiffel tests the wings were fastened with compact screws on the suction side, while by the Teddington tests the models were fastened on the pressure side. As known, any disturbing element on the suction side entails quite a drag which increases with the angle of the incidence while any disturbing influence on the pressure side brings a decidedly lower and with increasing angle of incidence a decreasing drag. Therefore I believe that from this point of view the Göttingen arrangement (6 very thin wires) is the most satisfactory.

4. *Drift coefficients and the results.*

In regard to drift coefficients, we will perhaps in time come to the agreement to give the absolute coefficients, since in the quality as dimensionless quantities they have the same value for each rational measuring method. Then it would be easy to calculate the coefficients adapted to individual countries. More satisfactory perhaps it would be if the engineers would adapt the absolute system in its entirety.

In the absolute system itself there are two different definitions. One, only used in Germany and Austria so far, pertains to drift, to velocity head (dynamic air pressure) $\frac{1}{2} \rho V^2$, i.e the pressure appearing as maximum pressure before an obstruction. In English-speaking countries the drift stands for double this aerodynamic pressure (velocity head), also ρV^2, resulting in the coefficients being half as great as the German coefficients. In favor of the German system let me say, that this quantity $\frac{1}{2} \rho V^2$ is obtained directly by speed measurements with Pilot tubes and the relation of air resistance to the Pitot pressure is especially natural. Then again, the drift coefficients of many objects (level, circular disc, circular cylinder, etc.) are by this method approximately 1.

To demonstrate these test results we have developed here in Germany already complete solid forms, for the testing of wings and aeroplane models, as well as for propellers. For wing tests, the lift coefficient as a rule is taken as starting point. This complies in one way with the results of the wing theory, where the lift presents the given quantity, and in the other way for the technical measuring reason that by usual measurements the lift determination is more accurate than the determination of the angle of incidence, which before was used mostly as an independent changeable, added to this, that the definition of the angle of incidence O^0 is often arbitrary. The now usual method of wing measurement is shown in Fig. 3. As introduced by O. Lillienthal, lift and drift are carried at right angles to each other, thereby giving the drift, according to the Eiffel method, as 5 times scale of the lift. The result is the so-called polar curve. Alongside of this the theoretical polar curve is shown, which according to the wing theory would correspond to a wing with equal aspect ratio but without profile resistance. The distance between this theoretical parabola and the measured curve shows the profile resistance, which according to our test results is quite independent of the aspect ratio, and shows to be very satisfactory for judging the quality of the profile. The angle of incidence, in many calculations occupying a very negligible place, is written on the individual points of the polar curve.

To show the position of center of pressure the moment coefficient on the leading edge (absolute coefficient for this moment) is given and indeed as being independent on the lift as the deciding quantity. The moment curve is therefore to be preferred, because it runs almost in a straight line, and makes the interpolation of values between the given values very easy. But by the curve, giving the position of center pressure direct, any interpolation is often very difficult, because the lift curve O is infinite. The position of center pressure can anyway be deduced from the moment curve through a simple construction.

The ratio lift-drift, given in English literature mostly, need according to our method not be shown especially, since it can be obtained by simply drawing a straight line from point O to the respective place on the polar curve.

And this ratio is at that not the deciding factor to determine the quality of an individual profile, because it is dependent quite a lot on the aspect ratio, and because that point, which gives maximum lift-drift in a certain plane, is only determined by the parasite drift of the aeroplane.

The showing of propeller test results have in the last few years been brought down to uniformity as well. Details are given in an article by F. Bendemann and A. Madelung in Technische Berichte Bd. II PP 53, etc. Its main drawing (table 40) approaches the methods of Eiffel and Rith. The absolute torque is taken as function of flying speed ratio to periphery velocity ratio in logarithms and the efficiency is shown in numbers.

It is my desire to have this article lead to a discussion of interested aeronautical experts and further through this discussion the question of standardization in Aerodynamics.

L. Prandtl,
Prof. University Göttingen.
(*translated by J. Vanier*)

SEAL HUNTING BY AIR

In a recent issue of the London *Illustrated News*, Edgar C. Middleton contributes an interesting article on the above subject, which reads as follows:

The story of man's conquest of the air has only just begun, for aviation is continually attacking new worlds. The latest advance has been made in alliance with the squatter, the trapper, and the hunter. Airmen recently have been assisting the hunters along the Grand Banks of Newfoundland in tracking down seals.

It happened in this way. A Newfoundland sealing captain who had returned to his calling from the war had watched the airmen hunting down U-boats among the grey wastes of the North Sea. He became aware of a certain similarity to his own business of sealing. There is something of the seal in a submarine, more than the fact that their habits are similar. The sealing captain put two and two together. An aerial observer who could spot the elongated form of a submarine from a distance of forty miles at 5,000 feet should add many hundreds to the catch when it came to seal-hunting.

His idea materialized, and in March of this year there arrived at the Bay of Exploits, northward from which lie the great sealing grounds, a small party of British airmen. Led by Mr. F. S. Cotton, a young Australian, this party included another and a spare pilot, a couple of mechanics, and two machines, and forthwith they got to work erecting their hangar on the shores of the bay.

Within a few weeks they were flying out hundreds of miles over the ice, cooperating with the ships in the sealing. In all, they coverd 2,000 miles of the ice-fields, or something like 20,000 square miles, in the first expedition, one flight taking them very far from their base. This aerial cooperation assisted in a catch of 110,000 seals.

Belle Isle is the centre of the great seal fisheries. There the seals pass the winter. There the flipperlings—young seals—are born, and from there, as the ice begins to break up with the spring, they and their parents come floating southwards on huge blocks of ice. Every year, regular as clockwork, towards the end of February, the ice-floes start floating couth. Every year, between March 21 and March 25, the entire seal nursery arrives off Fogo, where the sealing fleet waits their arrival.

The actual bagging of the seals is a comparatively simple matter. Immediately they are sighted, the entire ship's company take to the boats, and, clambering on the ice, club the seals over the head, skin them, and haul their skins and fat back to the ships, at the rate of thousands a day.

Like the old proverb, though, you must first catch your seal "before you sell his skin." In these vast seas it is no easy matter to track down even an army of 100,000 seals. From the time that the ice-floes arrive until the seals take to deep water again, far beyond the hunter's reach, is only a matter of a few weeks at most. In that brief spell either the sealers have made their catch, or they return to harbour empty-handed for another twelve months.

Sealing is one of the mainstays of the island. A bad season entails much poverty and hardship, and during the last few years of the war, the sealing business went from bad to worse. Another bad season would have meant bankruptcy for the sealers, and so they called in the wonderful observational powers of the aircraft.

On a clear day, and from a height of 5,000 feet, the airmen had a view over the ice that extended to Belle Island, 150 miles away. At the same altitude it was possible to make out the dog teams on the surface of the ice below with the naked eye. Usually, however, the weather conditions the airmen had to endure were little short of appalling. For the most part the temperature stood at zero or below. Frequently they were forced to bring the machine down on the ice, while a great deal of their time was spent in dodging blizzards—at the first sign turning and racing for the shore at full speed. Had they been overtaken by one they would never have returned to tell the tale.

So in their log-book we find the following typical entries: "Blowing very hard . . . 9 P. M. Blizzard. . . . . Ice two feet deep. . . . . Wind blowing about 90 m.p.h., could see nothing. . . . . March 20th.—Made three attempts to get machine up from the ice. . . . . Forced landing two miles out in the bay . . . . warmed engine up with an oil lamp," etc. This warming up was a frequent occurrence in a climate where boiling water froze stiff as it was poured from a can, and the only way to get it into the radiators was actually to heat the metal parts of the engine.

To return to the log-book. One frequently runs across phrases like "A forced landing two miles out in the bay." Such landings were made on the surface of the ice at a speed of over forty-five miles an hour, the machine not pulling up for a hundred yards. Naturally, mishaps occurred—fortunately, none of them serious. Tail skids would snap, and once the machine became so firmly embedded in a heavy snow-bank on the ice that it took three horses and a dozen men the best part of six hours to drag her free again.

Last sealing season the gales were the worst within living memory of the islanders. The inhabitants took to their huts and did not venture forth again till the fury of the storm had vented itself. All the trains were snowed up for over a month, and the aeroplane was the only means of transport available. In the midst of the sealing work an urgent wire was received from the Postmaster-General of Newfoundland to fly out with a mail-bag to St. Anthony, an outlying island. Despite a heavy snow storm, the bag was delivered, and the plane again returned in safety.

The machine that Mr. Cotton was flying was a "Westland," fitted with a Napier-Lion engine. In this same machine he made his famous flight 320 miles out and home across the ice fields.

That day they carried an experienced sealing captain aboard, and he was able to track down the seals by certain signs on the ice surface. It was encrusted all over with low brunt ridges, or "pancake" ice. The prevailing wind was westerly, and, as neither of these conditions was conducive to a lair for young seals, he came to the conclusion that they had passed below a few hours previously and were now making off eastward for deep water. Shortly after they flew near the sealing fleet itself. They signalled to it by wireless: "Turn about! Sail east! The seals have passed below and are now making for the open sea." The sealers took the hint. Within twenty-four hours their catch totalled 110,000 seals.

Meanwhile, warned by change of wind and gathering clouds that a dreadful blizzard was approaching, the aeroplane turned for home at top speed. Barely had the airmen got the machine within its hangar before the blizzard broke, within a couple of hours piling up many feet of snow against the doors.

Nothing daunted by these adventures, Mr. Cotton is off again in a few weeks' time for Newfoundland. Next sealing they anticipate being at work weeks before the ships go out, and in the meantime are to give the fishermen a hand in spotting cod and take a turn with the whalers, out after seacrows and humpback whalers. An aerial mail service across the bay to Labrador is yet another experiment at which they are going to try their hand during the summer months."

PERFORMANCE OF A VANE-DRIVEN GEAR PUMP

By R. H. HEALD
Bureau of Standards

(Technical Note of the National Advisory Committee for Aeronautics)

THE maintenance of an adequate and uniform supply of fuel for an aeronautical engine during flight is an important consideration in aeroplane design. In order to eliminate the uncertainty involved in feeding directly from the supply tank to the engine, the gasoline is frequently pumped upward to a smaller tank located within the upper wing from which it flows by gravity to the engine carburetor. The pump may be driven either (1) by the engine directly, or (2) by some type of wind wheel or rotor mounted so as to be in the relative air stream during flight. The purpose of this paper is to present the results of a test on a pumping unit of the latter type.

The test was conducted in the high speed wind tunnel at the Bureau of Standards on an Aeromarine Plane & Motor Corporation pump.

The driving unit consists of four hemispherical metal cups, 2¾ inches in diameter, mounted on a spider, the hub of which is threaded to take the connecting shaft of the pump. The unit may be mounted on the aeroplane so as to be either entirely in the air stream (Fig. 9) or partially enclosed in a sheet metal housing (Fig. 8).

The pump is of the gear type, the gears being enclosed in a metal casing cast in two sections. The gears have a 1-inch face and a pitch diameter of ¾ inch. The bore of both the inlet and outlet pipes is ¼ inch. The weight of this unit is 2.3 pounds, and the total weight of the equipment, including both driving and pumping units, is 3 pounds.

Method of Testing

Wind Tunnel Test of Delivery.

Measurements of the quantity of fuel delivered per minute were made at various wind speeds, (1) with the housing in place and (2) with the vanes entirely exposed to the wind stream. Fig. 8 shows the mounting of the apparatus with the housing in place. The mounting with the housing removed is shown in Fig. 9. The wind speeds were determined from Pitot tube measurements, assuming a standard density of .00123 gms/cm³.

Kerosene having a specific gravity of .817 was used in place of gasoline throughout the test, because of the necessity of mounting the pump in proximity to the switchboard controlling the wind tunnel motor.

The delivery of the pump when equipped with the wind-vane housing (Fig. 8) was measured at the wind speeds of 60, 80, 100 and 120 miles per hour, under the following conditions:

(a) With a constant intake head but with different discharge heads,

(b) With a constant discharge head but with different intake heads,

(c) With a constant intake and discharge head but with a different length of discharge hose,

(d) With a constant head and hose length but with elbow-equipped hose nipples or a tee equipped with hose nipples, attached to the end of the discharge hose.

The delivery of the pump was also determined with the vanes not enclosed for various discharge heads (Fig. 9). The rotational speed of the pump with constant discharge head and hose length, both with and without enclosed vanes, was also measured for different wind speeds.

In all the tests the radii of the hose bends were fixed and the lengths of both the intake and discharge hose were maintained constant, except when determining the effect of the length of hose on the delivery of the pump. The bore of the rubber hose used in this test was ⅜ inch. The hose layout is shown in Fig. 10.

Test of Efficiency of Pump.

The efficiency of the pump was determined by driving it directly with a one-fourth HP., 220 volt, D.C. shunt motor. Measurements were made of the power supplied to the motor when running without load. The pump was then connected to the motor by means of a short extension shaft and the hose arranged so as to give conditions identical with those given in Table 1. As in the wind tunnel test, the amount of oil delivered by the pump was determined by weighing. At the same time, the electrical input to the motor and the rotational speed of the pump were determined.

Head Resistance of the Vanes.

In measuring the head resistance of the vanes, the bearing supporting them was mounted directly on the end of an upright strut of streamline form. The strut extended through the tunnel so that the lower end projected below the tunnel floor and was supported by a knife edge mounted on the floor of the tunnel. A weighing arm carrying knife edge and weighing pan was attached to the lower end of the strut at right angles to it and pointing upstream. Suitable weights for

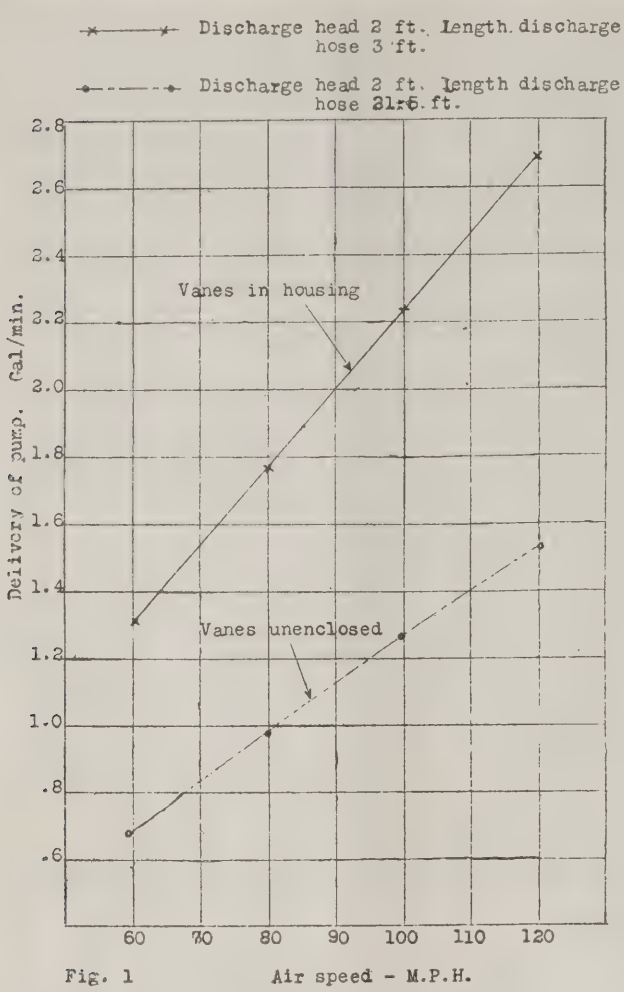


Fig. 1

counterbalancing were also provided. The pump was mounted on the strut outside of the tunnel and was connected to the driving vanes by means of the extension shaft. The hose was arranged for a discharge head of two feet using a three-foot length of hose on the discharge side and a two and one-half foot length on the intake side. The entire set-up was a duplicate of that indicated in Table 2.

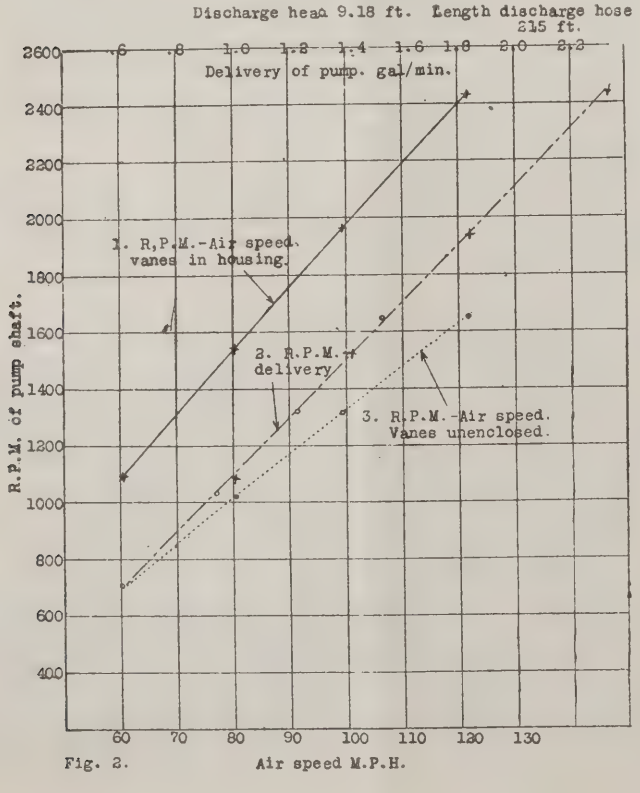


Fig. 2.

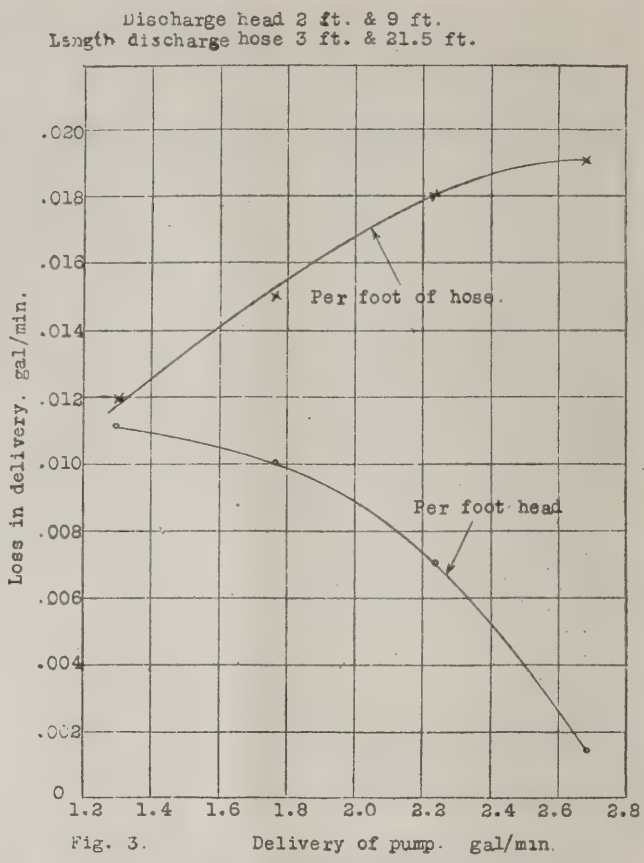


Fig. 3.

In measuring the head resistance of the vanes when enclosed in the housing, it was necessary to modify somewhat the arrangement just described. The housing was placed in the side of the tunnel as for the delivery test (see Fig. 8), and the balance was supported from the floor of the room. Measurements were made of the head resistance of the vanes, with both the enclosed and unenclosed mounting for a range of wind speeds of from 20 to 120 miles per hour. Measurements were also made of the head resistance of a single vane projecting into the tunnel normal to the wind stream.

Performance and Characteristics of the Unit.

Table 1 and Fig. 1 give the delivery of the unit when wind driven, both with the vanes in the housing and with unenclosed vanes. The effect of adding the housing is to increase the delivery at a given wind speed approximately 75 per cent.

Table 1

Discharge head 2.0 ft.
Intake head .22 ft.

Vanes unenclosed. Length discharge hose: 21.5 ft.		Vanes in housing. Length discharge hose: 3.0 ft.	
Air speed m.p.h.	*Delivery gal/min.*	*Air speed m.p.h.*	*Delivery gal/min.*
59.8	.68	60.2	1.31
80.5	.98	80.2	1.77
99.9	1.26	100.0	2.24
120.6	1.53	119.8	2.69

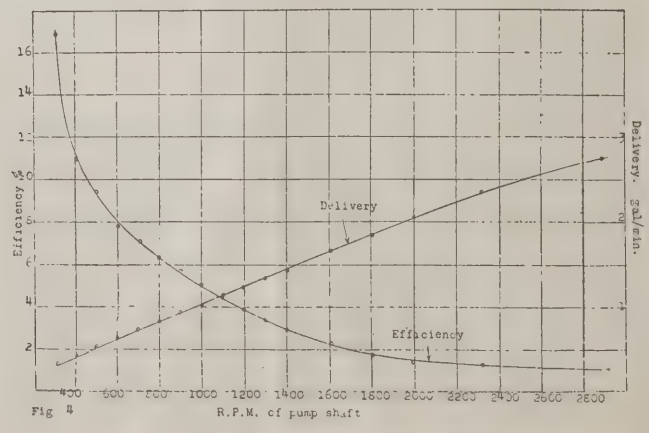


Fig 4

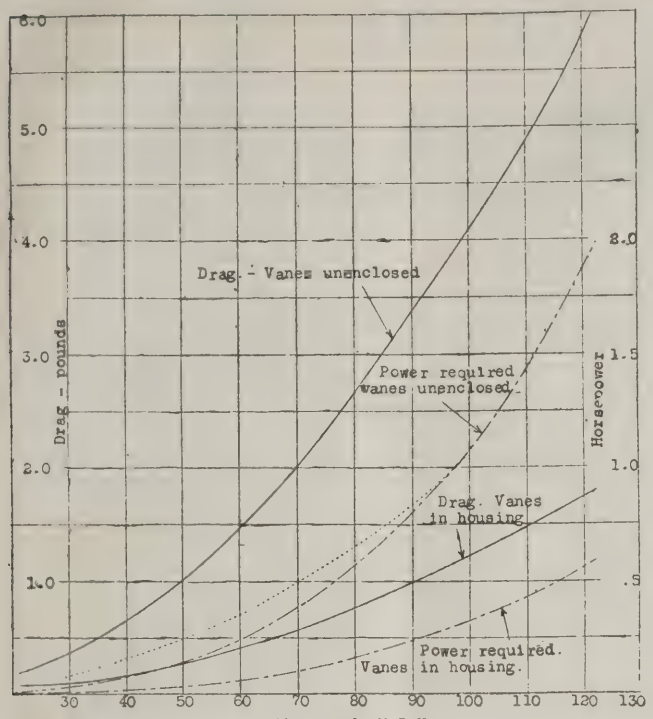


Fig. 5.

The delivery of the unit is proportional to the wind speed. The rotational speed of the pump shaft is also proportional to the wind speed. The inter-relationship of these quantities is shown in Fig. 2.

In Fig. 3 are presented the average results of a series of tests made for the purpose of determining the correction to be applied to the delivery rating for each additional foot of hose or foot of discharge head. The delivery is decreased approximately 1% for each foot of hose added.

The resistance of a tee is equal approximately to that of a foot of hose, and of an elbow to that of 2 ft. of hose.

Assuming the pump delivery to be the same for gasoline as for kerosene and assuming the fuel consumption of the engine to be 0.55 pounds per brake horsepower per hour, the pump with the vanes in the housing would deliver fuel for 1650 b.h.p. at an air speed of 100 miles per hour, with the short connections given in Fig. 1. With the vanes mounted entirely in the air stream, the conditions being the same, the pump would

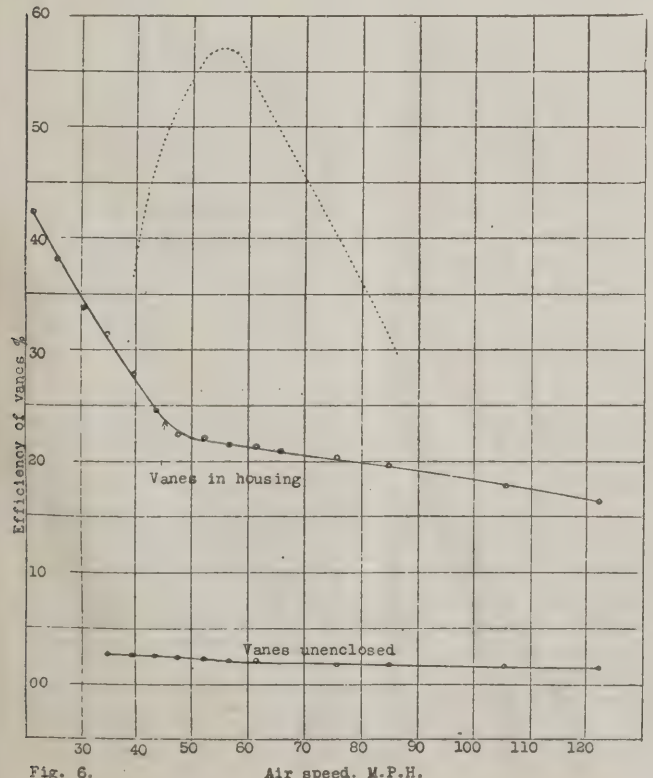


Fig. 6.

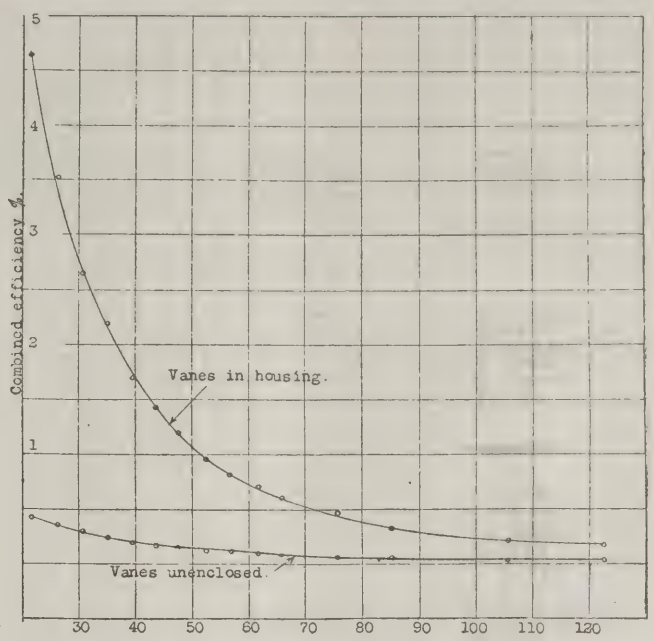


Fig. 7.

deliver sufficient fuel for 920 b.h.p. at an air speed of 100 m.p.h.

Performance of Pump when Motor Driven.

The delivery of the pump is directly proportional to the rotational speed of the shaft up to 2200 r.p.m., but above this speed the coefficient decreases slowly. The efficiency of the pump is low, the maximum efficiency (17%) occurring at the lowest angular speed (310 r.p.m.) at which observations were made. The efficiency decreases rapidly with increase in speed

(*Continued on page* 90)

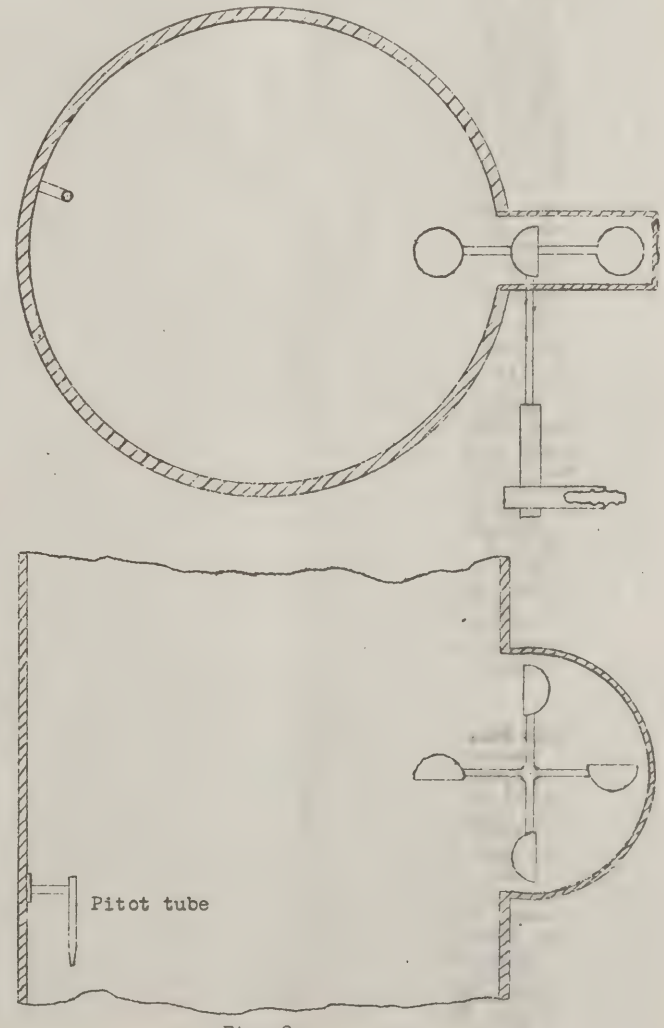


Fig. 8

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut Street
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
J. SIDNEY OWENS, *2d Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. BAMBERGER
CHARLES L. HOWER
GEORGE S. IRELAND
FRANK A. L. LEAHY
JOHN W. PRATT
D. J. SPENCE, JR.
A. STANLEY TRUSCOTT

AN item of news of much interest to the members of the Club is the announcement that a branch of the famous Fokker aeroplane factory, from which came virtually all the best fighting planes used by Germany during the war, is a likelihood for Philadelphia as the result of a recent visit to this city of a representative of Anthony H. G. Fokker, the Hollander who designed and built the planes bearing his name.

H. P. French, who came to the Industrial Bureau of the Philadelphia Chamber of Commerce, a direct representative of the famous aeroplane builder was placed in contact with that organization through Sheridan Taylor, its secretary, with some leading Philadelphia business men who are interested in aviation.

As a result of this conference, Mr. French returned to New York to get in contact with his company in Holland with a view to continuing negotiations looking to the establishment here of a plane plant and also for the starting of a campaign of education to make possible commercial aviation in the line of freight and passenger carrying here and throughout the East.

Mr. French said that Fokker not only was still producing the planes of the type which Germany used during the World War, but also was turning his attention to greater cargo carrying and passenger carrying planes. He also stated that the visit of Mr. Fokker to this country recently, had been responsible for the launching of a big "American plan" for commercial aviation and that plans were progressing so favorably that an American plant soon would be needed. Philadelphia, he said after looking over the ground, was ideally located from the standpoint of materials to be the home of an aeroplane plant.

On September 13th, word was received by several of the officials of the Club that one of the large Fokker planes of the London-Paris type would fly to Philadelphia from the Mineola field, hurried plans for a landing field were made and the large monoplane arrived in Philadelphia early in the afternoon, having been in the air but 75 minutes from the time of its leaving the New York field. Later in the day it left the field of the Aero Service Corporation at 73rd and Elmwood Avenue and with Governor Allen of Kansas returned to New York. The plane which was of the five passenger type had been sent here to carry to New York a copy of the resolutions adopted at the luncheon of the Chamber of Commerce. Bert Acosta, America's most famous test pilot, piloted the plane during the trip to and from Philadelphia.

A seaplane modeled specially for Secretary of the Navy Denby was recently given flight tests at the Philadelphia Navy Yard. Recently completed at the aircraft factory there, the plane was remodeled to give greater comfort and larger passenger accommodations.

The craft is a standard seaplane of the F5L type and was piloted in its tests by Commander Richardson, chief engineer of the aircraft factory and Lieutenant McFall. As soon as fully tested out the plane will be flown to Washington and turned over to the Secretary.

The Coroner's jury at the inquest into the death of Conrad M. Foss, aviator, who was killed with two passengers on August 28th, when his plane went into a nose-dive and fell to earth, recommended the appointment of a city commission on flying. The jury which was specially selected by Assistant Coroner Paul was composed of fliers and aviation experts and brought in a verdict that they found no one criminally responsible for the accident.

"We recommend," the verdict read, "that a commission be appointed by the proper city officials to draft the proper rules and regulations to govern flying, including registration of machines, examination of pilots, inspection of flying fields, equipment and protection given the public.

"Unless proper supervision is given passenger-carrying flying we are going to have a repetition of the accident that just happened." Members of the jury conferred with Director Cortelyou as to air regulations, following the inquest. "At present" said Charles L. Hower of the Philadelphia Aero-Service Corporation, with flying fields at Hatboro, "there is insufficient regulation over fliers and flying. I understand a code is being planned by the American Bar Association and certainly a competent commission of flying men and aeronautical experts should be appointed to consider the supervision of aerial navigation."

The jury was selected by the Coroner's office as follows Foreman, Walter Johnson, former aviator and at present a banker; Frank Mills, aviator of the Essington School of Flying; Frazer Kolb, banker and former aviator; Casper Druding, aviator at Hatboro Field; William H. Sheahan, first vice-president of the Aero Club of Pennsylvania, and Lieutenant Charles Vandeveer of the U. S. Air Service.

On August 27th a plane carrying a photographer, swung close to the statue of Penn on the top of the city hall tower, and took several "close ups" of that famous personage. The plane was sent up by the Welfare Federation in charge of Captain Douglas Robertson, U. S. A., from the Clementon field to the field at Elmwood where George Hardy, a camera man for the Stanley Company of America was taken on.

As the machine neared city hall, Captain Robertson dropped down to 500 feet altitude to allow Hardy to get within range of William Penn, whose picture is to be used in the introduction of the Welfare's film, "One Call, One Heart, One Answer" which is to be shown during the Community Roll Call in November.

The stated meeting of the Club was held on evening of September 16th and plans were discussed whereby it is hoped to greatly increase the membership of the organization. The entertainment committee are working out plans for interesting meetings during the Fall and Winter months and lectures of popular subjects in connection with aeronautics will be given by well known aviation experts. Mr. Steinmetz, president of the Club has just returned from abroad after an extended trip in France and England and will no doubt have much to tell the members at the October meeting which will be held in the Club room October 21st, 8 P. M. A full attendance to welcome the return of our president is requested. The usual notice will be sent to all members a few days in advance.

W. H. SHEAHAN, 1st Vice-President.

4,250-Mile Air Taxi Trip

What is asserted by the De Haviland Company, of London, to be the longest and most successful air taxi trip in the history of flying was completed in Paris, September 15, after 4,250 miles had been covered since the air taxi left its aerodrome on August 25. The company announced the aeroplane was under charter to H. J. Fox, an Englishman. He went aboard the air taxi in the French capital and visited Brussels, Amsterdam, Hamburg, Copenhagen, Stockholm, Christiania, then back to Copenhagen, to Berlin, Warsaw, Prague, Vienna, Venice, Milan, Nimes, Trieste and then to Paris again.

During the long air journey many stops were made, but there was nothing like a serious accident and Mr. Fox was able to go about his business without delays such as would have been caused by stops to make repairs.

When he ordered the air taxi he said he had important business that must be completed rapidly. An air taxi offered the only chance. Mr. Cobham went along as pilot, but did not take a mechanic. He took a few spare parts, however, such as spark plugs and valves, and a hundred different maps for guidance.

The feat, which has been completed successfully, is regarded by the De Haviland Company as without precedent. The company asserts the trip establishes a world record for mileage made by a flying machine in private hire and solo piloting.

Mr. Fox has congratulated the De Haviland Company on the achievement and said he was enabled to do his business in a tenth of the time that would have been consumed in taking trains. Also he said the air trip was infinitely more comfortable than a train trip.

The aeroplane used was a regular DH-9 with a tonneau especially equipped and places for extra fuel and luggage.

NAVAL and MILITARY AERONAUTICS

Bombing the Alabama

Norfolk, Va.—Concentrating their attack upon the abandoned battleship Alabama, army airmen on Sept. 23 demonstrated the effect of auxiliary weapons of modern warfare. A fleet of planes from Langley Field poured a constant fire of chemical bombs on the ship, at times hiding her completely from view in dense clouds of white smoke and flooding her decks with tear gas.

At noon a Martin bomber flew by at seventy-five miles an hour, dropping four 100-pound phosphorus bombs, each of which struck squarely on the vessel. As the "eggs" hit the battleship the phosphorus splashed up and fell to the decks in gray clusters of spray. Flashes of flame glowed through the thick smoke, but were almost instantly obscured by a cloud of dense white fog.

The Alabama was hit on the after fighting top, on the bridge, just aft the forward turret and on the stern. For a long time flames burned the planking on the Alabama's deck, and when the army and navy observers went to view the effect upon the target the fire was still raging.

As no men were stationed on board the Alabama during this or any other test, the personnel of the ship was represented by wooden boxes at various posts. Practically every one of these was scarred and discolored by the phosphorus gas, showing that if the ship had been manned her officers and enlisted men would have been knocked out by the choking chemicals.

The experiments were not to show that a ship can be destroyed by aeroplane fire, but that just as effective a result may be obtained if her system of fire control and her communication systems can be disrupted and the nervous systems of the human beings on board her are shattered.

Besides phosphorus bombs, smoke bombs were used to show that a heavy smoke screen could be so dropped that it would entirely hide oncoming aircraft and also the target itself. There were additional and more elaborate smoke screen tests later.

Still another experiment was conducted with tear-gas bombs. Three direct hits were made with bombs manufactured at Edgewood Arsenal especially for use during the Mingo miners' war.

These contained only a 10 per cent. mixture of tear gas, for they were intended to frighten rather than to injure for a long period. The bombs were so drastic in their effect that forty-five minutes after they struck the vessel observers were unable to penetrate the ship without gas masks.

The assault with the phosphorus bombs won the praise of Air Commodore L. E. O. Charlton, Air Attaché of the British Embassy, who was aboard the mine planter Mills, one of the observation craft. Army airmen applauded as the phosphorus smoke curled above the Alabama. Naval officers reserved judgment.

On September 24 the tests were continued.

A Martin bomber riddled the forward decks of the old battleship Alabama with two 300-pound demolition projectiles.

Though only 173 pounds of TNT was used in each bomb, the direct hit on the bow of the ship tore through her first deck, spreading the sides of the jagged hole upward so far that the guns in her forward turret would have been unable to sight above the wreckage.

The crew's quarters below this deck were demolished. A second bomb, dropped with the first, followed through the hole made by the first, causing more destruction.

In addition to the Martin bombers, a fleet of eight swift SE-5 planes dropped thirty-two bombs, many of which struck the ship in vital spots. Her communication systems were shot away, her fighting masts badly damaged and some of her searchlights were put out of commission.

Before the bombing, nine De Haviland-4 planes attempted to lay a smoke screen across the starboard side of the target. Many fell short or did not ignite, but eight caught fire, the white smoke rolling upward in a fan-shaped cloud that hid all the vessel except her prow.

The attacks followed a midnight test, in which planes dropped half a dozen bombs on the Alabama. One struck the ship with such a deafening crash that military and naval observers, asleep on some of the vessels anchored nearby, leaped from their cots in alarm.

This night bombing resulted in several hits, the effects of which could be easily seen when the observers went aboard the Alabama.

Navy Officers Pass Examinations.

Eighty-five per cent of the Reserve Officers of the Pacific Fleet Air Force and from the Naval Air Station passed the recent examination for permanent commissions in the U. S. Navy, according to Capt. Henry C. Mustin, who returned to San Diego from Washington Wednesday. The new assistant chief of the newly created Bureau of Aeronautics added that but 50 per cent of the officers on the Atlantic Coast taking this same examination were able to make a passing mark.

Captain Mustin was full of praise for Rear Admiral William Moffett, the chief of the Bureau, stating that much credit for the successful reorganization is directly due to the Admiral's efforts.

It was also stated by the former commander of the Pacific Fleet Air Force that it would be found necessary to drop a total of 70 officers and 1,100 enlisted men from the Naval air forces within a short time. There will be no curtailment of the activities of the various air units, he said.

Captain H. V. Butler has been selected to fill Captain Mustin's place as commander of the Pacific Fleet Air Force, but Captain Mustin will remain on the coast until November 1. It is anticipated that Commander Towers will be transferred to the East Coast.

Night Flying is Suspended

Night flying has been suspended at the North Island station by order of the commanding officer, and it is not known when it will be resumed.

The newly created bureau of aeronautics at Washingtgon has allowed the station only $9,000 a month to cover all operating expenses, and this is not sufficient to cover the expenses incurred in night flying.

Rockwell Field Resumes

Active flying is to be resumed at Rockwell Field in the near future, according to a recent order from Washington. An observation squadron will be permanently stationed at Rockwell. The squadron will consist of 24 officers and 90 enlisted men, who will be drawn from personnel now at March Field and at Rockwell. Resumption of the Army aeroplane forest patrol service throughout the Ninth corps area of the Army was also announced at Rockwell Field. According to air officials 60 De Haviland planes are now making flights daily over the vast forest reserves in California, Oregon, Washington, Idaho and Montana. The air patrol service has been at a standstill for some time, due to a shortage of funds. The patrol will come to a stop with the advent of the first rains in Oregon and Washington. In California it will cease about October 10.

Maj. H. H. Arnold, air officer of the Ninth corps area, is now on an aeroplane tour of inspection of the Army patrol service. He is making flights over the forest reserves throughout California, Oregon and Washington, inspecting the field stations of the Ninth and 91st aero squadrons.

Maj. Shepler W. FitzGerald, commander of Rockwell Field, left yesterday for a two weeks' vacation at Yellowstone Park. Capt. William Randolf will act as post commander during the absence of Maj. FitzGerald.

Dirigibles May Fly to Alaska

Two of Langley Field's airships, the D-3 and D-4, are scheduled to fly across the continent to California and thence to Nome, Alaska, and return to California.

This will not only be the first attempt at a trans-continental flight in lighter-than-air craft, but also the most comprehensive flying project yet outlined for dirigibles in this country.

Air Service Orders

Ignico, Lt. R. V., to the Cmdg. Off. Langley Field for asignment with airship company.

Bond, Lt. C. F., report to Cmdg. Offr. Langley Field for assignment.

Smythe, Lt. C. E., report in person to the Comdt. Airship School, Langley Field, for duty on the school staff.

Holland, Lt. H. H.; Thomas, Lt. A.; Olmstead, Lt. R. S.; Smith, Lt. J. A., relieved from further training at the airship School, Langley Field; report in person to the Comdt. that school for duty on the school staff.

Biggs, 1st Lt. R. D., to Kelly Field.

Myers, 1st Lt. D. M., to Langley Field.

FOREIGN NEWS

Argentine Record

Pilot Luis Barrufaldi at Palomar field in a 300 h.p. Bristol biplane, with his mechanician as passenger, made the altitude of 7,400 meters in an hour and a half. This is considered the South American record for altitude with a passenger.

Capt. Olivero in a 220 Balilla aeroplane beat the previous South American altitude record by ascending to 8,000 meters in 1 hour and 15 minutes. He first circled over Ituzaingo, Moron, Temperly and El Palomar, gaining altitude, and next over the center of Buenos Aires, the island of Martin Garcia, San Fernando and Lomas de Zamora. Upon reaching 7,500 meters an hour after rising he surpassed the altitude record of Major Hudson of Bolivia. From then on the cold and rarefied air were much more trying to the aviator, who began to lose consciousness, and after reaching 8,000 meters he started to descend, landing in El Tropeson, near San Martin.

Aero Club of Uruguay

The Aero Club of Uruguay was recently founded to work for the benefit of national aviation.

Five hundred meters has been set by official decree as the lowest altitude at which aviators may fly military aviation school aeroplanes for acrobatic performances. To fly lower than this altitude with Government aircraft, written permission must be obtained from the director of aviation.

Sadi Wins Italian Grand Prix

In connection with the Italian Grand Prix for motorcars at Brescia, from September 4 to 11, a "Gran Premio d'Italia d'Aviazione" was flown on September 4, which was won easily by Sadi Lecointe, on a Nieuport-Delage biplane, 300 Hispano-Suiza engine. Thirty-six entries for this race had been received, of which the following started: Stoppani (Ansaldo), Ganzini (Gabardini), Leonardi (Gabardini), Baratini (Spad), Beghetti (Gabardini), Ferrario (Ansaldo), Brack Papa (Fiat), Lordi (Fiat), Sadi Lecointe (Nieuport-Delage), Massi (Spad), Zambelli (Gabardini), and Lovadina (Ansaldo). The course was one of 280 kiloms (174 miles), and was covered in the shortest time by Sadi, whose time was 1 hour 13 minutes 9 seconds, or an average speed of 132 m.p.h. Brack Papa on the Fiat was second, his time being 1 hour 18 minutes 58 seconds.

Entries for Deutsch Cup

The final entries list for the Coupe Deutsch, to be flown at Etampes on October 1, is as follows: (1) Hanriot (Rost), (2) Lumiere de Monge (de Romanet), (3) Nieuport, (4) Sesquiplan Nieuport-Delage, (5) Sesquiplan Nieuport-Delage, (6) Mars I (J. H. James), and (7) Fiat. The pilot of the Fiat is not yet announced, but will probably be Brack Papa, who obtained second place in the Italian Grand Prix. The pilots of the Nieuports will be Lannes, Kirch and Lecointe, although it has not yet been announced who will pilot which. It appears probable that Lannes will fly the older type (No. 3), while Kirch and Lecointe each take one of the new one-and-a-half planes (Sesquiplan). It is extremely gratifying to see the Mars I entered for this country, and knowing the machine and pilot we have no hesitation in saying that we feel sure the French pilots will have all their work cut out. It is one thing to establish speed records over a kilometer, with the human element entering into the timing with stop-watch, but quite another to fly in the same race, and we personally have every hope for the British entrant with his 450 h.p. Napier Lion engine.

The International Michelin Cup

Poirée on a Caudron biplane succeeded in putting up a good performance for the Coupe Michelin. It is scarcely correct to say that he has won it, as there is still time for some other competitor to improve on Poirée's performance. The rules of the competition stipulate that the circuit of France shall be covered in 15 stages, with compulsory landings at each of the following aerodromes: Versailles (any one of the various aerodromes situated in the Versailles district), Amiens, Mourmelon-le-Grand, Saint-Dizier, Dijon, Joigny, Beaune, Bron (Lyon), Nimes, Pau, Merignac (Bordeaux), Romorantin, Angers, Evreux, St.-Inglevert (Calais), Versailles. Competitors are allowed to start from either one of these aerodromes, and apparently the only stipulation is that a "commercial" speed of at least 75 kilometers per hour shall be maintained. Intermediate landings are permitted. The full rules of the competition appeared in "Flight" on February 17.

The last holder of the cup was Eugene Gilbert, who covered the circuit of France (3,000 kilometers) in 39 hours, 35 minutes 42 seconds in 1914 (June 8-9) on a Morane-Saulnier monoplane, 80 h.p. le Rhône engine. The turning points of that circuit were somewhat different, although the total distance remains the same. The war prevented the competition for the next few years, and post-war conditions have been responsible for the non-holding of it until this year.

The first man to make the attempt was Bossoutrot, the famous Farman pilot. His machine was a "Farman Sport," a small biplane with 45 h.p. Anzani engine. Starting from the Lyon aerodrome at Bron shortly before 5.30 a.m. on Friday, August 19, Bossoutrot landed at Nimes about 8 a.m. and, after filling up, proceeded to Pau, where he arrived at 12.25, leaving again some ten minutes later. Scarcely had he got away, however, before he had to make a forced landing, during which he damaged his undercarriage. The reason for the forced landing is given as engine trouble caused by the poor quality of the petrol with which he was supplied at Nimes. Bossoutrot had to abandon the attempt.

The second competitor to make an attempt was Bajac, who was flying a Spad-Herbemont, 80 h.p. Rhône engine. He started from Buc (one of the aerodromes in the Versailles district) at 5.51 on August 28, and proceeded toward Amiens, his first landing point. He was heard circling about, but owing to fog he was unable to locate the aerodrome, and finally, after circling round several times, had to return to Buc, where he landed about 8 o'clock.

The next day he made a fresh start at 5 hours 28 minutes 52 seconds. He arrived safely at Amiens and proceeded toward Mourmelon, where he alighted at 7.40. Leaving again five minutes later, he made his prescribed landings at Saint-Dizier and Dijon, arriving at Joigny at 10.05. After "signing the book" he left again at 10.15 for Beaune, where he landed according to the rules, proceeding toward Bron, where he landed about 2 o'clock. After filling up he got away from Bron at 2.50 and landed at Nimes at 4.36. Getting away again at 4.48, he headed for Pau, where he landed just before dark. Getting away early the next morning, he proceeded toward Merignac (Bordeaux), but engine trouble forced him to land at Tarbes, and he gave up the attempt.

The third attempt was made by Poirée on a type 60 Caudron biplane, 130 h.p. Clerget engine. This machine, a *fuselage* biplane, similar in a general way to that used by Poirée in the Monaco speed contest. Leaving Villacoublay (one of the "Versailles" aerodromes) at 4 hours 49 minutes 22 seconds on the morning of August 29, he touched at Amiens and landed at Mourmelon at 7.10. After filling up he left at 7,50, Saint-Dizier and Dijon were passed, and at 10.05 he landed at Joigny, at the same time as Bajac. Leaving again at 10.15, both pilots proceeded together, but the superior speed of the Caudron with its 130 h.p. engine soon left Bajac behind, and a landing was made at 1 o'clock at Bron. Here a stop of one hour was made for lunch and replenishments, and at 2 Poirée got away for Nimes, where he landed at 3.58. Getting away again at 4.22, he headed for Pau, which was reached at 8.00. After spending the night at Pau, Poirée left at dawn on August 30 and arrived at Merignac (Bordeaux) at 7.08, leaving again at 7.12. Romorantin was reached at 11.05 and left again at 11.10. By midday Angers was reached, and getting away from there at 12.45, Poirée landed at Evreux at 2.30. Leaving at 2.35, he landed at St. Inglevert (five miles S.S.E. of Calais) at 4.25 and got away again at 4.30, arriving at the home aerodrome at Villacoublay at 6 hours 03 minutes and 02 seconds, having completed the 1,860 miles in 37 hours 14 minutes 40 seconds, or at an average speed of just under 50 m.p.h. This figure includes, of course, the time spent at aerodromes and the stop overnight at Pau. In other words, it is elapsed time and not flying time. Thus for the time being, at any rate, Poirée is the holder of the cup. It is, however, more than likely that other competitors will make the attempt before the end of the year and, by a better performance, become temporary holders of the cup.

The Voyage of the "Quest"

It is possible that the voyage of the "Quest," under Sir Ernest Shackleton, may lead to a substantial addition to the sum of knowledge of the conditions obtaining in the upper air. Sir Ernest recently offered his services to the British Air Ministry to carry out meteorological observations and to gather topographical information during his forthcoming expedition to the Atlantic, Southern and Indian Oceans. The "Quest" has been furnished with instruments and equipment necessary for carrying out observations, and she has been constituted an official reporting ship to the Meteorological Office. She has also been supplied with photographic apparatus and with kites similar to those employed in the investigation of the upper air over the Atlantic during the voyage of the s.s. "Montcalm" prior to the flight of "R-34" in 1919. It is further proposed to take records of the temperature and pressure of the upper air by using a seaplane which is to accompany the expedition. As the ship will, among other places, visit the islands of St. Paul's Rocks and Tristan d'Acunha, in the Southern Atlantic, some valuable data should be collected. The first of these groups lies on the route which would probably be followed by aircraft flying via a position almost midway between South America and South Africa.

Airplanes to Carry Gowns to London

Following the example set by *The New York Herald of Paris*, copies of which are brought to London by aeroplane every day and sold in the streets in the early afternoon, the Galleries Lafayette, a well known French department store, which is opening its London branch has announced that not a single frock for its opening was completed before the middle of this week, and some of them will not be finished until the day of the opening, when they will be loaded on special aeroplanes and rushed to London for the opening.

Sport Farman Wins

The Sport Farman, piloted by Bossoutrot, won the International Contest for touring aeroplanes at Brussels on September 3rd and 4th.

The Late Bernard de Romanet

Captain Bernard de Romanet, the noted French aviator, holder of the world's speed record for one kilometer, was instantly killed at Etamps, France, on September 23 while taking part in the elimination races for the Deutsch de la Meurthe Cup.

The canvas on Romanet's machine tore while he was flying more than 100 miles an hour at a height of 650 feet, and the plane fell. The machine was a biplane, from which the lower plane had been removed for the sake of speed.

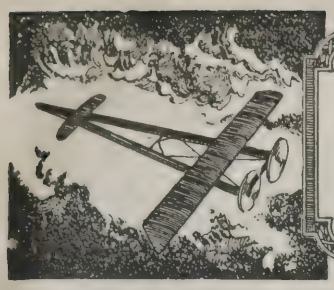
Captain de Romanet's world record for speed was established on November 4 last, when at the Buo Airdrome, near Paris, he flew over a measured kilometer at the rate of 309 kilometers, twelve meters an hour (about 193 miles), covering the distance in 11 65-100 seconds. He was a competitor in the James Gordon Bennett Cup race in France last September, which was won by Sadi Lecointe, and in the following month established a new world's record for one kilometer, in 12.3 seconds. His record was eclipsed by Lecointe the following day with a flight in 12.1 seconds, but this was in turn shattered by de Romanet in his notable dash of November 4.

London-Paris Air Mail Twice Daily

The British Postmaster-General announces that, in extension of the facilities already provided for the acceptance at certain Post Offices of parcels for transmission to Paris by aeroplanes of the Instone Line, arrangements have been made for a second dispatch of air postal parcels on and from September 1, and until further notice, by Messrs. Handley Page's daily aeroplane service to Paris, leaving Croydon aerodrome at 12.30 p. m. The new dispatch will enable air parcels for Paris to be posted at certain Post Offices in London on the morning of dispatch.

The new dispatch will also enable air parcels to be posted at certain provincial towns up till a later hour over night than is at present possible, if connection is to be made with the existing dispatch.

Delivery should normally be affected in Paris on the day of dispatch from London by either service.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



What A Model Club Can Do

By W. H. DeLancey, Illinois M. A. C.

MODEL flying requires a lot of hard work and patience which seems to be a combination which few boys possess. Yet in spite of this fact The Illinois Model Aero Club can truthfully say that as it approaches its tenth anniversary it is a stronger and sounder organization than ever before in its history. Its activities of the past six weeks are typical of what it has accomplished in the past and what any club can do if it wants to get out and work.

On July 10, a hydro contest was held at Lake Calumet and Mr. B. Pond seemingly unsatisfied with the old hydro record of 118 seconds, broke it first by a 133 seconds flight and then by a remarkable flight of 172 seconds. This makes Mr. Pond the holder of two world's records for he broke the hand launched tractor distance record last September by a flight of 2,465 feet. (Incidentally on September 5, Mr. Pond raised the R. O. G. duration record to 184.8 seconds.)

At the regular business meeting of July 14, Mr. Lucus, who is one of the "reasons" for The Illinois Model Aero Club being the foremost organization of its kind in the world, reported after weeks of work that the club had been donated a space in the Pageant of Progress exposition by the city of Chicago. Plans were immediately laid for a booth and when the opening guns of the Pageant were fired two weeks later, The Illinois Model Aero Club had probably the best booth ever presented by a model club.

For two weeks nearly fifty thousand people each day stopped to look at these models and nearly a hundred boys paid their dues to join the thinned but sturdy ranks of the I. M. A. C. Almost continuously, slow flying tractor models were kept drifting about in front of the club's booth and thousands of people saw for the first time "one of those things that would really fly."

During the Pageant of Progress an indoor contest was arranged to take place in the large auditorium on the Municipal Pier. This turned out to be by far the most successful indoor contest ever held by The Illinois Model Aero Club. Mr. Pond repeated his performance of four weeks previous, and moved the indoor record up from 130 to 170 seconds. Mr. R. Jaros also went over the previous record and other flights were consistently over the 100 seconds mark. Mr. Pond won a beautiful pair of tubular racing skates donated by the Alfred Johnson Skate Company and Mr. Jaros won a handsome wrist watch donated by Mr. J. Fitzgerald, general manager of that company. Mr. Pond flew a twenty inch model weighing .19 (nineteen one-hundredths) of an ounce. The club is to receive also, as a result of the Pageant of Progress, a beautiful silver loving cup probably to be given for one year to the winner of the annual scale model contest.

The first meeting after the exhibition was another triumph for the club. In spite of a bad storm, over seventy-five members were there and heard the best speakers it has ever been the lot of the club to have present.

The meet of July 21 saw the best flying in several years. Mr. R. Jaros won with an average of 148 seconds. Mr. Pease's model (which held the record back in 1918) came to the front again when it made a flight in this contest of 179 seconds, so far the high mark of the year.

The Illinois Model Aero Club wants to help other clubs, to promote model flying, to help the United States lead the world in aviation. If there is any way in which model flyers of this or any other country can be helped, the I. M. A. C. expresses its willingness to extend its fullest cooperation and invites correspondence from any club or individual interested.

Prize Model Aeroplane Contests Held in New Jersey

In a series of model aeroplane contests held at Camp Edwards during the summer months, which closed recently, the winners were: Samuel Kleinfield, sixteen and Herbert and John Enstice, fourteen and thirteen, of Kearny, N. J.

The contests, free to boys and girls, were held under the direction of Charles Weslow of East Orange, who also is interested in a model yacht racing among New York and New Jersey school boys. Only one girl, Ruth Meiser, fourteen, of Allenhurst, competed. She won a contest.

Herman Pulle, fifteen, of Jersey City, was the winner of the first contest. Governor Edwards, who happened to be passing at the time, complimented the winner. The Governor's grandsons were prominent in the eighth contest, the younger grandson carrying off the honors for a "fancy spiral dive." Some of the contestants had their own models while others used those loaned by the director.

One of the interesting events of the contest was an eleven loop-the-loop stunt by Allen Price of New York, in a model built by himself. One of the prizes offered was a high aeroplane ride in a passenger carrying plane piloted by Captain Paul Micelli, a former aviation officer. Philip Thurr, fourteen, of Sea Girt, won this award.

Mr. Weslow now holds contests on Sunday afternoons on the aviation field at Linden.

Woods Used in Aircraft Construction

(Continued from last week's Issue)

Ash

The varieties of ash are white ash, Biltmore ash, green ash, pumpkin ash, Oregon ash, black ash, and blue ash. There are about ten other species of ash, none of which, however, are of commercial importance.

The ashes known commercially as "white ash" include both white ash and green ash as well as the Biltmore and blue ashes. All of these are very desirable woods for use in aircraft. It is used extensively for longerons, bent work on wings and fuselage, landing gear and other parts of the framework of aircraft and has been used to some extent for propellers. Black ash is not so stiff as the others but is good for bending as it is quite tough. Pumpkin ash is lighter and weaker than the other ashes and therefore is not desirable for aeroplane construction.—(From National Advisory Committee Report.)

Basswood

This species is also called linden, linn and whitewood.

Basswood is light in weight but its strength is low. It is one of the best woods in ability to take nails without splitting and is excellent for webs of wing ribs and for ply wood cores generally. It is also used for thin flooring plank.

Beech

Having strength properties very similar to those of birch and maple, it makes a fairly satisfactory propeller wood where requirements are not too exacting, and was used for this purpose in Europe to some extent. It is also a satisfactory material for ply wood.

Birch

Sweet birch is also known as black birch, cherry birch and mahogany birch. Yellow birch is also known as silver birch, swamp birch and gray birch.

Birch of these two species is quite heavy, hard, stiff, and resistant to wear, of uniform texture, and takes a fine finish. It makes satisfactory propellers and has been used for that purpose in several countries.

Birch ply wood is widely used in aircraft manufacture. Because of its resistance to wear, its stiffness, and ease of bending, it is especially good for face ply, where thinness is essential.

Black Cherry

Cherry wood is a strong, fairly hard, straight grained, works well, and takes a fine finish. It is an excellent propeller wood and is also good for ply wood facing.

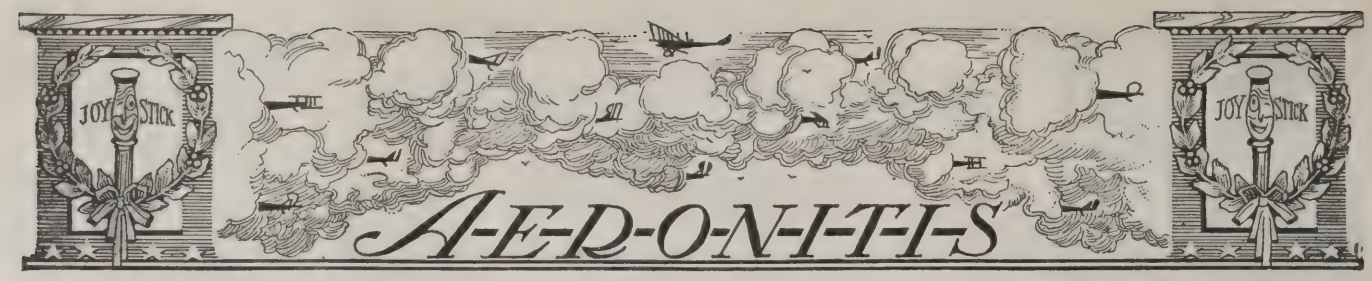
Elm

There are five principal species of elm used in aircraft. Cork elm, known as rock elm, cork-bark elm and hickory elm. White elm, known as American elm, water elm and gray elm. Slippery elm, known as red elm and rock elm. Wing elm, known as wahoo, witch elm, cork elm, small-leaved elm, red elm, water elm and mountain elm. Cedar elm, known as red elm and basket elm.

Elm is slightly heavier than ash and rather low in stiffness, but very tough and shock resistant. It steam-bends very well, and may be substituted for ash in longerons and for similar uses. It is also used for other bent work such as landing skids and the keels of flying boats. Cork elm has been approved for propellers. White elm is used for bent ply wood.

All of the elms require care in drying because of their tendency to warp and to twist.

(To be continued)



A Few Movie Films

"The Monkey." A gripping tail.
"Secrets of Surgery." At cut rates!
"The Human Heart." This beats them all!
"Limburger Cheese." It turns them away!
"Eyes, Nose and Mouth." A feature film!
"Wedded and Parted." In two parts!
"The Optician's Sign." A gigantic spectacle!
"The Sledgehammer." A smashing success!
"The Divorce Decree." Worth double the price!
"Mammon." The greatest love story ever told!
"Waists and Skirts," and other short subjects!
"Amsterdam, Volendam and Rotterdam." Passed by the Board of Censorship—very reluctantly.
"The Garden of Eden." Come early and avoid the rush!

—*Cartoons Magazine.*

Cave Country Politics

Mr. Skinpants: "I s'pose you know I'm a candidate for county assessor? I reckon you won't turn your back on an old pal like me, huh?"

Mr. Multiskins: "You bet I'll never turn my back on an old pal like you. You'd be likely to jab a spear in it."—*Judge.*

Tour Interrupted

"I'm not a common tramp, your honor," said the tattered individual who was charged with vagrancy.

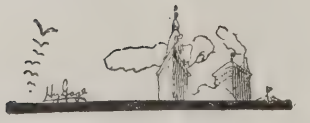
"What are you, then?"

"I'm a tourist. I started out to see America."

"Your tour will be interrupted for six months. Next case."

—*Birmingham Age-Herald.*





"TRAMPING AIN'T WOT IT USETER WAS—THANK GOODNESS!"

Passing the Buck

Kindly Old Lady: "You are a very nice little boy to give your candy to your little friend."

Youthful Hard Guy: "Aw, he ain't no friend of mine."

"Then why did you give him the candy?"

"The flies was botherin' me."—*Youngstown Telegram.*

The Altruist

Sceptic: "If you have such an infallible remedy for baldness, why don't you use it?"

Subtle Barber (very bald): "Ah, sir, I sacrifice my appearance to bring 'ome to clients the 'orror of 'airlessness."—*Punch.*

First Pilot: "Where's your passenger you took up?"

Second Pilot: (innocently) "How should I know?"

He: "Do you think a girl should learn to love before twenty-one?"

She: "No! That is an entirely too large an audience."

Jack: "Here comes a plucky girl."

Jim: "How da ya know?"

Jack: "Look at her eye-brows."

Nemo: "Did you meet a man with one leg by the name of Saunders?"

Cockney Bill: "H'i sye, wot's the nyme o' 'is other leg?"

Colonel: "That 'bird' over there just asked to be made a pilot. Is he steady?"

Pilot: "That's my mechanic. Sure, if he was any steadier he'd be motionless."

Teacher: "Translate 'rex fugit'."

Stude: "The king flees."

Teacher: "You should use 'has' in translating the perfect tense."

Stude: "The king has fleas."

Capt.: "Is the young lady you visit popular?"

Lieut.: "I should say so! Why she even has to have a chaperone when she accompanies me on the piano."

Observations

Did you ever notice how long and full the skirts were a few years ago?

Well, nowadays I guess the modern girl seems to be saving on the goods to show how conservative she is and how extravagant grandmother was.

Then too, she may want to show her fattened calves. (I beg your pocketbook).

Just to show how clean she is, I'll explain. Long skirts pick up germs and she doesn't like it a'tall!

So the Air Service is of some use. A germ would have to be an aviator to get on *her* skirt now, eh, what, Rollo?

—*Edna McDonald.*

Superfluous

"I have here a book entitled, 'The Successful Chicken Raiser,'" began the agent.

"I don't need it," broke in Uncle Cy Hopkins. "All my children are boys."—*Exchange.*

Polite Hint

Customer—"I say, do you ever play anything by request?"

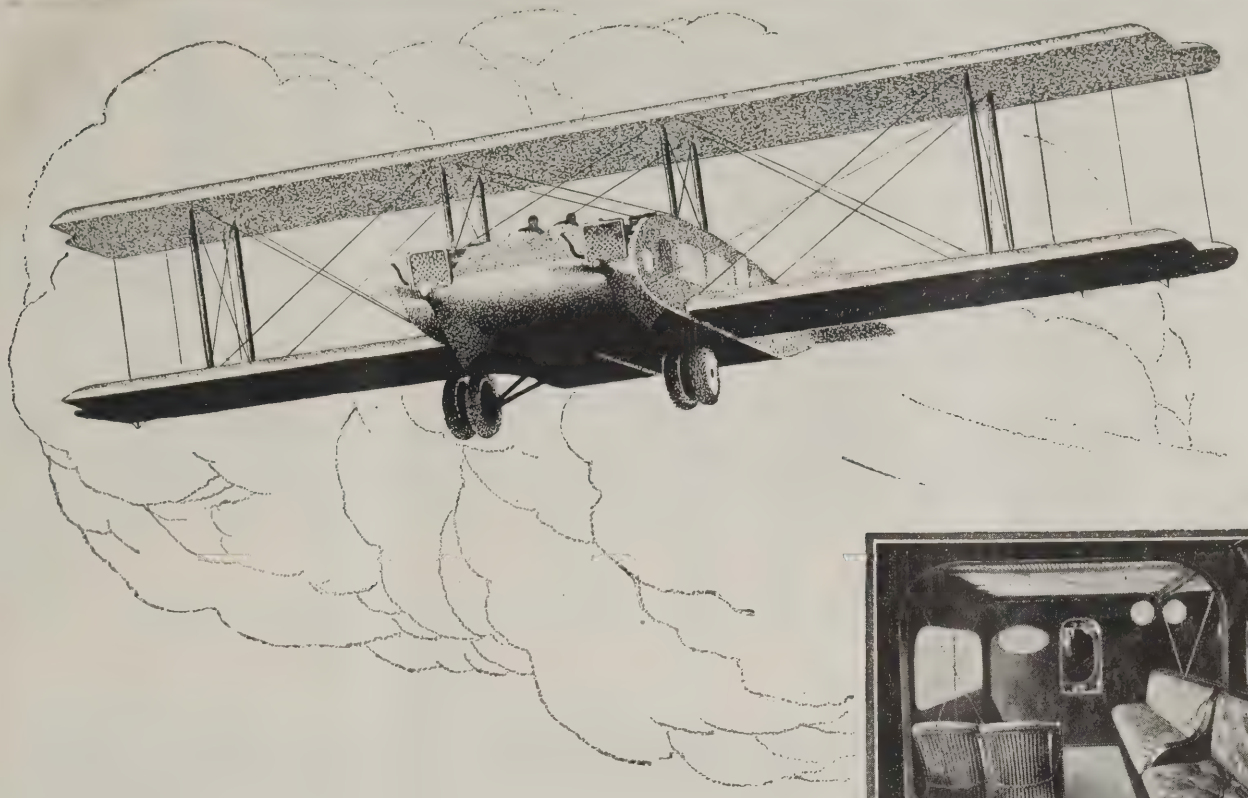
Delighted Musician—"Certainly, sir."

Customer—"Then I wonder if you'd be so good as to play a game of dominoes until I've finished my lunch."—*Punch* (London).

Generosity

Nurse: "Why, Bobby, you selfish little boy! Why didn't you give your sister a piece of your apple?"

Bobby: "I gave her the seeds. She can plant 'em and have a whole orchard."—Kingston *Standard.*



Thirty passengers find comfortable accommodation in the luxurious cabin of the Airliner. In the view above but half of the cabin is shown

A New Giant Plane

STRIKING in appearance, unusual in design, is the Remington-Burnelli Airliner, with its span of 70 feet. The fuselage, built in the shape of an aerofoil, houses a cabin 14 feet wide and 20 feet long, the largest cabin ever provided on any heavier than air machine.

Mr. Vincent Burnelli, designer of the Airliner, writes:

> ". . . . The giant size of our plane necessarily caused us to believe that it would be difficult to locate shelter for it on the average flying field, and therefore it could be expected to experience considerable exposure. This required us to devote much forethought to the waterproofing necessary to prevent deterioration and failure of glue joints. We feel confident that in adopting Valspar for our finishing material we have to the greatest possible degree obtained our aim. Our confidence is based on extensive previous experience in weather-proofing aircraft."

From long experience Mr. Burnelli knew that Valspar is proof against water and weather, vibration, oil, and grease. And so—

Inside and outside, the Airliner is *Valsparred, of course!*

VALENTINE'S
VALSPAR
The Varnish That Won't Turn White

VALENTINE & COMPANY
Largest Manufacturers of High-grade Varnishes in the World
ESTABLISHED 1832
New York Chicago Boston Toronto
London Paris Amsterdam
W. P. FULLER & CO., Pacific Coast

AEROCRAFT
MOTORS
WINGS POWER

BORNE SCRYMSER COMPANY
AERO
MOTORSOL
TRADE MARK
TYPE
NEW YORK

OIL—ACE
PRACTICALLY PROVEN
ADVOCATING AERO MAIL

(*Continued from page* 83)

to slightly more than 1% at 2900 r.p.m. The efficiency and delivery of the pump are given in Fig. 4 and Table 2.

Table 2

Discharge head 2.0 ft.
Intake head .22 ft.
Length discharge hose 3.0 ft.

R.P.M.	*Delivery gal/min.*	*Efficiency %*
310	.314	16.9
405	.411	11.0
500	.519	9.5
600	.623	7.9
700	.725	7.0
800	.823	6.2
900	.917	5.6
1000	1.01	5.1
1100	1.12	4.4
1200	1.22	4.0
1300	1.33	3.3
1400	1.43	3.0
1610	1.66	2.2
2330	2.36	1.3
2900	2.75	1.1

Resistance and Power Characteristics.

The power required for driving the unit with the vanes unenclosed at a speed of 120 m.p.h. is nearly 2 HP., while with the vanes in the housing the power required is slightly more than one-half horsepower. Fig. 5 and Table 3 give the values found for the head resistance of the vanes and the power required at the various wind speeds and emphasize the advantage to be obtained by enclosing the vanes in a housing.

Table 3

Air speed	*Vanes Unenclosed*		*Vanes in Housing*	
m.p.h.	*Drag (lbs.)*	*HP. required*	*Drag (lbs.)*	*HP. required*
21.3	.184	.010	.057	.003
26.0	.275	.019	.075	.005
30.4	.377	.031	.106	.009
35.0	.501	.047	.130	.012
39.3	.630	.066	.168	.018
43.4	.763	.088	.201	.023
47.3	.906	.114	.250	.031
52.2	1.10	.153	.303	.042
56.5	1.29	.194	.355	.054
61.2	1.53	.249	.426	.069
65.5	1.77	.309	.487	.085
75.4	2.36	.475	.670	.136
85.0	2.97	.674	.864	.196
105.4	4.49	1.26	1.34	.376
122.2	6.09	1.98	1.79	.583

The dotted line in Fig. 5 represents the drag of a single vane held normal and concave to the wind. The data obtained in this test are in fair agreement with the results of Eiffel on a hemispherical cup 10 inches in diameter. Table 4 gives the comparative results.

Table 4

Air speed	*Drag*	*Values of K*	1)
m.p.h	*lbs.*	*Eiffel*	*Author's*
29.6	.171		.0040
39.3	.302		.0040
43.9	.377		.0040
51.6	.522	.0034	.0040
65.1	.842		.0041
74.2	1.115		.0041
82.0	1.36		.0041
89.2	1.63		.0042
93.2	1.83		.0043
99.4	2.09		.0043

Combined Efficiency and Efficiency of the Vanes.

The term "Combined Efficiency" as used in this paper, is expressed as the ratio $\frac{P}{P_1}$, where P_1 is the power absorbed by the unit from the moving air stream (air speed × head resistance) and where P is the power output of the pump (delivery × total head pumped). The efficiency of the vanes is readily determined by dividing the combined efficiency of the unit by the efficiency of the pump. The results are summarized in Table 5, and the curves are given in Figs. 6 and 7.

Table 5

Air speed	*Efficiency of Vanes*		*Combined Efficiency*	
m.p.h.	*Unenclosed*	*Enclosed*	*Vanes unenclosed*	*Vanes encl.*
	%	%	%	%
21.3		42.2	.43	4.66
26.0		38.5	.37	3.54
30.4		33.8	.31	2.66
35.0	2.13	31.2	.25	2.20
39.3	2.09	27.6	.21	1.72
43.4	2.02	24.4	.18	1.45
47.3	1.93	22.3	.16	1.21
52.2	1.81	22.0	.14	.97
56.5	1.67	21.4	.12	.82
61.2	1.58	21.2	.10	.71
65.5	1.49	20.8	.09	.61
75.4	1.37	20.2	.07	.47
85.0	1.36	19.5	.06	.34
105.4	1.39	17.7	.04	.30
122.2	1.37	16.4	.03	.17

These results again illustrate the decided advantage to be obtained by shielding the convex sides of the vanes from the air stream by some form of housing. At a wind speed of 60 m.p.h. the efficiency of the vanes is increased from 2% to 21% by the use of the housing, with a consequent increase in the combined efficiency of the unit from 0.1 to 0.7 per cent.

1) The resistance may me expressed by the formula: $R = KAV^2$
Where R is the resistance of the body in pounds.
A is tthe area in square feet,
and V is the wind speed in feet per second.

LOWEST PRICES IN STOCK PROMPT DELIVERY
COTTON
CLOTH GRADE "A" 36" WIDE. U. S. ACCEPTED
TAPE
ALL WIDTHS, ALL MATERIALS—PINKED AND FRAYED
WHEELS
26" x 4" — NEW — 1½" AXLE — BRONZE BUSHINGS
AIR TRANSPORT EQUIPMENT INC.
630 VERNON AVE., L. I. City, N. Y.

105
A Engng.

AERIAL AGE WEEKLY

UNIVERSITY OF ILLINOIS LIBRARY

VOL. 14, No. 5 OCTOBER 10, 1921 10 CENTS A COPY



Airscape of the Greenwich Village Section of New York City. Photographed for the Fairchild Aerial Camera Corporation by W. L. Hamilton

Information for Pilots Giving the Practical Characteristics of the Land Along Various Air Routes

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
scriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

$20,000.00 in PRIZES!

$10,000.00 in CASH — $10,000.00 in TROPHIES

CONTACT! Off for Kansas City! Get into the biggest Aerial event in history. Bring on your ships. Take home the bacon—$20,000 worth of prizes in real coin of the realm and handsome trophies. A gigantic Flying Meet for every type of plane. Make your plans NOW to come to the—

OFFICIAL
American Legion
FLYING MEET

(In conjunction with the Third Annual American Legion Convention)

KANSAS CITY, MO.—OCT. 31—NOV. 1 & 2

A mammoth Spectacle of the Air for three days and nights. Meet your old buddies. Meet America's foremost aces and scores of other notables. See the greatest collection of ships ever assembled. And take part in your favorite events. A meet the world will talk about!

FREE Gas! — FREE Oil! — FREE Service!

At the Field for All Contestants!

A Few of the Events:

THE LEGION DERBY

Open to any make of plane, horsepower, or wing spread. Machines to start at scratch, race over a triangular course of 5 miles, 30 laps or 150 miles in all. Prize one leg on a cup costing $2500.00. This must be won twice to become the permanent property of the winner. Another beautiful cup, valued at $1200.00, will be awarded the winner of first place, as his permanent property. These prizes will be presented by the President of the United States on the floor of the Convention Hall. In addition, cash prizes of $3000.00 are offered for first, $2000.00 for second, and $1000.00 for third place.

STUNTING CONTEST

Three best planes will be picked for finals to be held on the following day. Absolutely no stunting to be done under an altitude of 1000 feet. $600.00 Silver Cup for first place.

LEGION JUNIOR DERBY

The Legion Junior Derby. Open to all ships of less than 100 miles per hour air speed. The race will be five times around a triangular course of 15 miles; 75 miles in all. Prizes—A large silver cup valued at $1250.00, to be awarded by the President of the United States in addition to cash prizes of $1000.00 for first, $500.00 for second, $200.00 for third, and $100.00 for fourth place.

RELAY RACE

Entries open only to JN4D's and Canucks, or ships of the same type. Four planes to a team. Teams will race from a standing start once around a 15-mile triangular course, 5 miles between corners. Prizes to the winning team, $250.00 cash to each pilot; second place $125.00 to each pilot, total $1500.00.

Looping Contests, Altitude Tests, Night Flights, Parachute Drops and scores of other events that will bring valuable Cash and Cup prizes to the winners.

OPEN TO ALL! Our official booklet containing full information on each event, cuts of trophies to be awarded in addition to cash prizes, rules of the course and field, is now ready for mailing. This booklet also contains official entry blanks. Send for yours at once. Don't miss this greatest of all Flying Meets. Write today.

Flying Club of Kansas City

Room 126 Hotel Baltimore **Kansas City, Missouri**

October 10, 1921

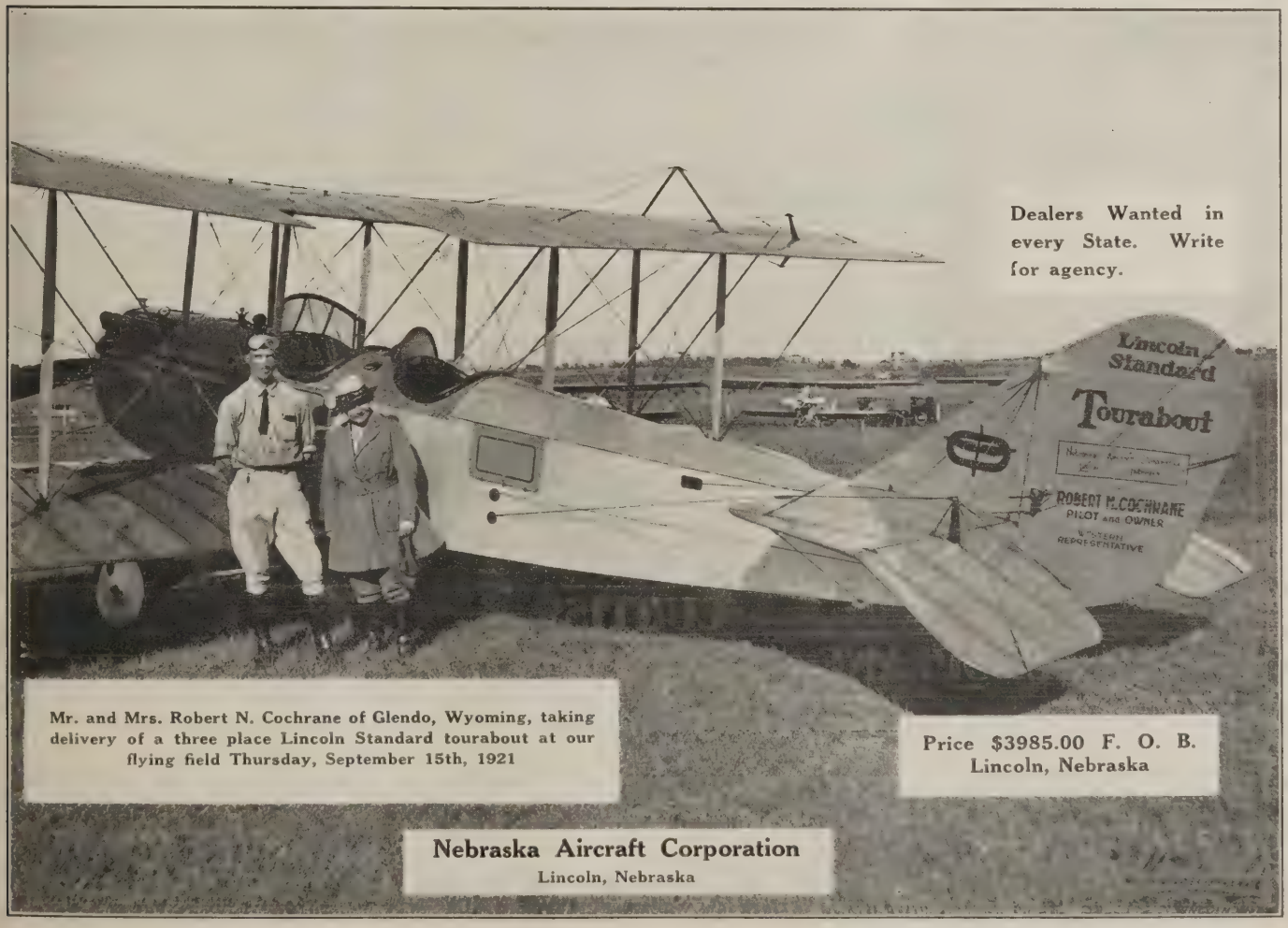
AERIAL AGE WEEKLY

VOL. XIV, No. 5

TABLE OF CONTENTS

General Mitchell on Bombing.... 99
The News of the Week..... 100
The Omaha Aero Congress..... 101
The Aircraft Trade Review..... 102
The Effects of Staggering a Biplane 103
Duralumin: Its Properties and Commercial Possibilities..... 105
The New Age 106
Information for Pilots Giving the Practical Character of the Land Along Various Air Routes..... 107
Naval and Military Aeronautics.... 110
Foreign News 112
Elementary Aeronautics and Model Notes 113
Aeronitis 114

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

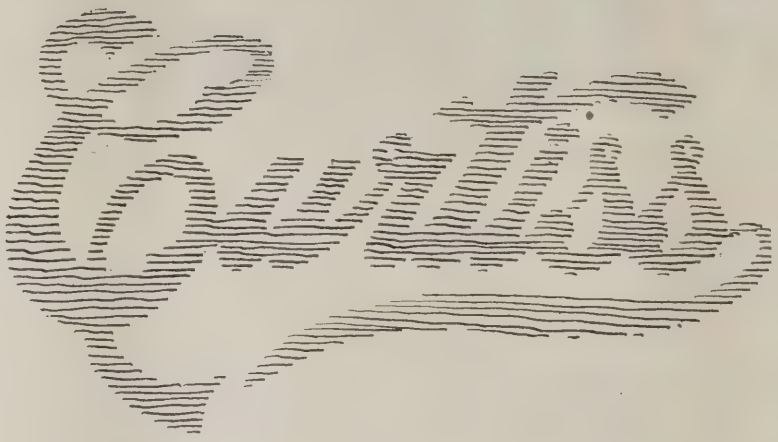


Dealers Wanted in every State. Write for agency.

Mr. and Mrs. Robert N. Cochrane of Glendo, Wyoming, taking delivery of a three place Lincoln Standard tourabout at our flying field Thursday, September 15th, 1921

Price $3985.00 F. O. B. Lincoln, Nebraska

Nebraska Aircraft Corporation
Lincoln, Nebraska



A Further Reduction

APPROXIMATING 25%

in the price lists of parts

for

Orioles
O X Standards

Jennies
C 6 Standards

is announced

EFFECTIVE SEPTEMBER FIRST

Write for revised price lists.

Motor price lists are not affected in this reduction.

CURTISS
AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor
B. C. BOULTON
Contributing Technical Editor
G. F. McLAUGHLIN
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., October 10, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, OCTOBER 10, 1921 NO 5

GENERAL MITCHELL ON BOMBING

GENERAL MITCHELL'S report on the bombing of the German ships and his estimate of the lessons to be derived therefrom have never been published verbatim for reasons best known to the War Department. And yet it may be said that this report hits the target in every sentence.

Conservatism in the Army and Navy vainly seeks to depreciate aviation in war. It insists that weather, darkness, speed and zigzagging, anti-aircraft guns, etc., will protect fleets and forts. The General's report punctures and flattens all these theories. He says:

"Air forces can find and destroy all classes of sea craft under war conditions with negligible loss to the air craft."

This statement is unquestionably true. The Ostfriesland tests proved it by day and the Alabama tests by night. He says further:

"Conditions of weather affecting air and sea conditions do not alter the statement made above, as air craft can operate under conditions under which sea craft cannot operate. For instance, a sixty-mile wind, low visibility near the water and operations at night are very difficult for sea craft."

This statement is justified. A fleet is helpless at night. The Alabama was bombed at night. A fleet is helpless in a fog. Planes can fly above the fog and attack fearlessly as the fog clears. The rolling and pitching of ships in a heavy sea will prevent anti-aircraft guns from hitting anything. Planes can attack with impunity. General Mitchell goes on:

"The Army Air Service was not permitted to attack the targets as it would under war conditions, and never was more than one-tenth of the force employed in a single attack."

This statement is undeniable. In some cases planes were compelled to fly around over the targets with heavy bombs for a half hour, waiting for permission to attack. The General's report declares:

"Had the Army Air Service been permitted to attack as it desired none of the sea craft attacked would have lasted ten minutes in a serviceable condition."

This is not an overstatement. If the German ships had been under way their boilers, engines, magazines, ammunition, steering gear and communications would have been exposed. An attack in full force with bombs, torpedoes, mines and poison gas would have destroyed or put them out of action in a single flight over the squadron. It is not necessary to sink a ship to render her useless in battle. General Mitchell continues:

"The First Provisional Air Brigade could have put out of action the entire Atlantic Fleet in a single attack. The money value of the aeroplanes did not exceed the cost of one modern destroyed."

This statement is perfectly reasonable. Our fleet has no air force capable of resisting such an attack. The Navy Air Force has a splendid and gallant personnel, but it lacks the weapons with which to fight. Naval aviation has been suppressed and discouraged for years.

Anti-aircraft guns are the only hope of our fleet. They are practically useless. Masts, smoke pipes, bridges, searchlights, radio and fighting tops filled with fire control personnel blanket these guns almost completely. They are a broken reed. They would be no more effective than so many pea shooters.

And the Alabama tests have proved that the air force can attack the fleet at night. What could the fleet do? This situation is appalling.

General Mitchell's warning to America goes on:

"At present there is a complete lack of liaison or system about our national defence. The duties are distributed between the Army, the Navy, the air force, the coast artillery, the army corps area commanders and the coast guard in such a way as to make it impossible to function efficiently in an emergency."

This is absolutely true. Our system is one of chaos. It spells confusion, turmoil and complete unpreparedness for modern war. There is no head.—(Editorial in N. Y. *Herald.*)



THE NEWS OF THE WEEK



Lieut. McCready Establishes New Altitude Record

Dayton.—Lieut. John A. McCready, test pilot at McCook Field, flew a La Pere biplane to a height of 40,800 feet September 28, breaking the record heretofore held by Rudolph C. Schroeder, who drove the same biplane to a height of 36,020 feet on February 28, 1920. The height attained by Schroeder, however, was later corrected to the true altitude of 33,114.

At 40,800 feet McCready's engine died with a cough and the daring flyer glided back to the field without any difficulty.

McCready was in the air one hour and four minutes, and landed none the worse for his experience, although he encountered a temperature of 50 degrees below zero. He was able to leave the field soon after landing. He encountered little of the trouble that almost killed Schroeder, whose eyeballs froze and whose heart dilated to such an extent that he was in a hospital for two weeks after his flight. Lieut. McCready, however, said that throughout the flight he suffered nothing but numbness from the cold, particularly in his hands, which became so stiff he could hardly operate the controls.

"When I left the ground," said Lieut. McCready, "I did not intend to go above 30,000 feet. However, when I reached that height I found my machine was working perfectly, and I decided I could obtain some valuable data by going higher. I commenced to spiral, and soon reached 40,800 feet, when I was obliged to descend.

"At 20,000 feet the temperature on the thermometer registered zero. The only time I was scared was just as I reached the 30,000 foot mark. At this point I slowed up my motor. This cooled the cockpit of the machine and my oxygen supply pipe froze on me.

"I grabbed an emergency bottle of oxygen and inserted it through a valve in the side of the helmet. I broke the bottle and revived myself. Upon speeding up the motor I found that the ice melted and I was able to breathe again. I do not know just where I was when I reached the mark. I made the ascent in large circles, extending as I reached a high altitude entirely around the city of Dayton. I think perhaps I may have been between Middletown and Hamilton when I reached the mark. I could not see Dayton, but I could see the rivers where they converge.

"I was aided by many things which have recently come into use in aviation. I used a special gelatine on the inside of my goggles to prevent freezing. Although some ice did freeze on them I was able to see fairly well at all times.

"Nature was with me on the trip. It was an ideal day for an altitude flight. The visibility was perfect at all times and I was able to see land, as no clouds interfered.

"The wind at that height was terrific. I can't tell just how fast it was blowing or in what direction. I would notice in making my spirals that I was blown rapidly off my general course when on one side of the ring.

"I am glad I made the record, of course. I like to hold a record. Any man does. However, the data that I obtained at that height is what I was after and I owe the lack of suffering on the trip to the new and scientific appliances which have been invented within the last year.

"My eyes did not suffer at all on the trip. Major Schroeder on his flight froze his eyes. I was able to see at all times, although not so clearly at times due to the lack of air. I suffered more from the lack of air pressure on my body than I did from the other cause.

"I noticed all during the trip above 25,000 feet that my hands felt like lead and that I could not move freely. However, I was able to handle the controls and to send the ship just where I wanted her.

"When I reached the ground I was able to walk about and felt fine in a few minutes, although I was a trifle weak and stiff from the cramped position and the strain. I walked into the hangar and then into the flight commander's office, where I made my report on the data that I had collected."

The instruments on Lieut. McCready's machine were taken to the technical data office of the flying field as soon as he had landed, and were calibrated by Lieut. Patterson and a corps of assistants to ascertain the true altitude record. The altitude registered on the plane as showing the highest point reached was 41,200 feet, but the true height after being calibrated was 40,800. These figures will be sent to Washington for confirmation, but officials of the flying field said they are certain their calibration was correct and that the record will stand.

The plane used by Lieut. McCready is equipped with a supercharger recently invented by Dr. S. A. Moss. This is an attachment which takes care of the engine during altitude flights, and which automatically changes the mixture in the carburetor and keeps the water in the radiator warm at all times, regardless of the temperature encountered. The preparations for the flight, which was primarily to test the supercharger, were under the supervision of Dr. Moss and Capt. George Hallet, chief of mechanical designing at McCook Field.

The biplane which has now twice shattered the world's altitude record was designed in January, 1918, by Capt. La Pere, a French aviator working under the direction of the United States Government.

During the record breaking flight the aeroplane was equipped with a new propeller, larger than it had been equipped with at any previous time. This was used in an effort to increase the altitude capacity.



© Underwood & Underwood

Assistant Secretary of the Navy Theodore Roosevelt, who flew to the American Legion Convention at Atlantic City from Washington, being greeted by Miss Elizabeth Edwards, daughter of the Governor of New Jersey.

Aero Club Dinner

The Third Aviators' Armistice Day Dinner given by the Aero Club of America will be held at the Hotel Pennsylvania on Armistice night.

This is the annual reunion dinner of all the Air Service officers from all over the United States to live over again the battles of the clouds in France. Plans for the developing of the aerial defenses of the country for the coming year will be discussed by eminent men in brief speeches, and the support of every Air Service officer and all others interested in aviation enlisted in this important work.

The dinner committee is as follows: Benedict Crowell, Chairman; Cole J. Younger, Vice-Chairman; Brig. Genl. Wm. Mitchell, A.S.A., Rear Admiral W. A. Moffett, U.S.N., Eddie Rickenbacker, Harold E. Hartney, Caleb S. Bragg, Col. G. C. Brant, Col. E. Garnsey Brownell, Douglas Campbell, Maurice G. Cleary, Col. Chas. H. Danforth, Chas. Jerome Edwards, Comdr. Jerome C. Hunsaker, U.S.N., A. P. Leoning, David H. McCulloch, Charles E Merrill, Capt. W. C. Ocker, U.S.N., Comdr. Albert C. Read, U.S.N., Philip J. Roosevelt, Col. E. H. Shaughnessy, Major William Sherman, U.S.A., James B. Taylor, Jr., Col. William Thaw, Lt. Comdr. Kenneth Whiting, U.S.N.

Deutsch de la Meurthe Trophy

Etampes, France — Lieut. Georges Kirsch of France won the Deutsch de la Meurthe Cup race here on October 1st. He covered 300 kilometres (186.3 miles) with five turns in 1 hour 4 minutes 39 1-5 seconds, or at the rate of nearly three miles a minute.

Sadi Lecointe, the noted French aviator, was injured and his aeroplane was smashed when he made a forced landing in the first lap of the race. He suffered wounds about the face, may lose his right eye and has deep cuts in both legs. His propeller was shattered while he was going faster than 300 kilometres an hour.

Lecointe was first to take the air, and had made splendid time for the first fifty kilometres, flying this distance in 9 minutes 33 4-5 seconds.

In winning the race, Lieut. Kirsch did even better than Sadi Lecointe, who in the James Gordon Bennett Cup race covered the same course in 1 hour 6 minutes 17 1-5 seconds.

Lannes, the other French pilot, who used the machine piloted by Lecointe last year, was the only other entrant to finish the race. He went over the course in 1 hour 9 minutes 55 2-5 seconds.

The British and Italian entrants abandoned the race after negotiating 100 and 150 kilometres respectively.

The Omaha Aero Congress

Aces of the World War, the intrepid chaps whose every flight over the Boche lines made constructive American history, will be buddies again with the "deuces" of Kelly Field and the air generals who fought the long seige of Chatillon-sur-Seine and Issoudon and the strident notes of, "Hail, Hail, The Gang's All Here" will render the air at the first International Aero Congress in Omaha, November 3rd-5th.

To date, 10,246 of them have been directly approached with insistent invitations to attend. Omaha will be the Flyers' Mecca November 3, 4 and 5, and the International Aero Congress shows every indication of bearing the same relation to the infant Aviation that the forthcoming Disarmament Conference bears to the world's peace, inasmuch as it will disarm the American public of its scepticism and seeming indifference toward aviation as a vast, far-reaching industry of the future.

The feature of the meet, of course, is the second annual contest for the Pulitzer Trophy, the stellar speed event of the upper strata. Entries must attain an air speed of one hundred and forty miles per hour to qualify for this event. Equal to the Pulitzer Trophy is the new Larson Trophy donated by John M. Larson, of New York, for efficiency of planes included in the class referred to as "commercial."

This is the latest acquisition to the imposing lists of trophies and cash prizes which totals $14,000.

The additional racing events are as follows:

November 3—Event No. 1. Pulitzer Trophy Race. First prize $3,000; second prize $2,000; third prize $1,000. Free-for-all race for high speed planes. Distance one hundred and fifty miles. Event No. 2. Acrobatic Contest. First prize, $250; second prize $150; third prize $100. Free-for-all contest for all types of planes. Contestants must climb three thousand feet directly over field before starting acrobatics.

November 4.—Event No. 3. Larson Trophy Derby. First prize $3,000; second prize, $2,000; third prize, $1,000. Race for all types of commercial aeroplanes. Distance two hundred and fifty miles. Event No. 4. Free-for-all race. First prize $300; second prize, $150; third prize, $125. Race open to JN4's, OX5 Standards, Orioles with Curtiss OX5 motor, Canucks and other planes with a speed from sixty to seventy-five miles per hour. Distance ninety miles. Event No. 5. Free-for-all race. First prize, $300; second prize, $150; third prize, $125. Race open to JN4H, C6, or K6 Orioles, Laird-Swallow, Bellanca CE, Lark, C6 or K6 Standard or equals a speed of seventy-five to ninety miles per hour. Event No. 6. Parachute jumping contest. First prize, $200; second prize, $100; third prize, $50. Open to all parachute jumpers.

November 5.—Event No. 7. Open race. First prize, $1,500; second prize, $700; third prize, $375. Closed handicap. Open to all machines. Distance one hundred and fifty miles. Event No. 8. Bombing Contest. First prize, gold cup; second prize, silver cup. Open to army and navy planes only.

The International Aero Congress will be an occasion for the reunion of the Lafayette Escadrille, the living American Aces, flyers who won the Distinguished Service Cross, former officers and enlisted men in the Air Service and Balloon Corps of the squadrons that fought the Hun in 1917 and 1918.

Invitations have been extended to Marshal Foch whose attendance is very probable; also to the Prince of Wales, Sir Douglas Haig, General Armande Diaz of Italy, and General Pershing and a score of other notables.

For the airmen attending, group reunions and banquets together with all the types of entertainment dear to the flyers' hearts will be given in their honor and on the last night, the closing feature will be the "Destruction of Courcellette," the aerial night pageant written by Rupert Hughes and Eddie Deeds, to be produced under the direction of the latter. A cast of seventy-five people will be used in the production and the French Village will be destroyed by Hun planes from the air which are subsequently downed by an American Ace.

A charming romance has been selected as the theme of the story and the illuminating effects will be under the direction of Mr. W. D'A. Ryan, the designer of the "Tower of Jewels" of the San Francisco Exposition. The General Electric Company is supplying an eighty million candle power searchlight to illuminate the air battle, which in itself will be a feature attraction.

The congress will be particularly valuable to aircraft manufacturers, as their market will be concentrated in one city for the first time in history. All who attend are asked to come prepared to look over the aeroplane market, as well as the accessories market, with a view of purchasing at this time.

S. E. J. Cox of Houston, Texas, was the first Pulitzer entrant to plant down his deposit fee. He is entering two crafts, one the Texas Wildcat, with C. B. D. Collyer as pilot, and the other the Cactus Kitten, with Clarence Combs at the stick.

The Aero Club of Utah has also pledged an entrant—a Thomas-Morse, with E. D. Steely as pilot. The Sioux City, Iowa, Flying Circus will have an entrant also, and four others have promised to have their entries in soon.

Nearly one hundred flyers of the middle west have promised to bring their craft to Omaha to take part in the other races and contests.

The Larson Trophy contest, details of which will be issued soon by the Aero Club of America, according to Captain Hartney will be interesting. Any craft is eligible, as the winning of the contest will be based on the formula $\frac{(w-t)\,s}{g}$, in which (w) stands for total weight leaving ground, (t) stands for weight of plane minus gas, (s) stands for miles per hour actually made over the course, and (g) for amount of gas actually consumed.

The course in the Larson contest will be 250 miles in length from Omaha to Des Moines and return. Most of the other races will be run over the 30 mile course which starts at Omaha Field.

The field has been prepared at a cost of nearly $50,000; Aero Club members helped prepare the field in their spare time, and the city spent nearly $30,000 in the construction of a sewer which traverses the field.

Entry blanks for participation in any of the races or contests of the International Aero Congress in Omaha may be had by writing to the Omaha Aero Club, Hotel Fontenelle, Omaha, Nebraska, U. S. A.



The latest British Airliner—the De Havilland 29, with Napier Engine. It is a cantilever Monoplane with capacity for ten passengers. Photo courtesy "The Aeroplane"

The AIRCRAFT TRADE REVIEW

California-Curtiss Company Organized

Erving G. Diess and Earl S.Daugherty, noted aviators and United States instructors during the war, have formed the California-Curtiss Aeroplane Company and have been appointed distributors for Curtiss aeroplanes for Southern California and Arizona.

Field headquarters will be maintained in Long Beach, where a $50,000 plant is to be established, and an office will be located in Los Angeles. Curtiss aeroplane agencies, under direction of dealers such as now obtain in the automobile industry, are to be promoted for the sale of machines and the promotion of the industry.

Diess and Daugherty have formed a partnership so as to combine two of the most prominent aviation factors in the West under one head. As a sales manager and aviator, Diess has sold probably more aeroplanes than any one individual in Southern California. As an aviator, Daugherty has been an exhibition and passenger carrying pilot for years, having obtained one of the first licenses issued by the Aero Club of America through the Aero Club of California.

Daugherty field at Long Beach is to be improved and equipped to meet the up-to-date demands of the fast developing aviation business. Hangars with concrete floors are to be built to house 10 planes, there will be a runway 3000 feet long and 290 feet wide, field offices and warehouses for storing parts are to be erected.

The company will handle aeroplane motors besides fully equipped machines. It will also have service stations where repairs can be made and planes and motors overhauled. A full stock of parts will be kept. Pilot and mechanical instruction will be given. Standard Curtiss machines will be handled, including the JN-4D planes, Orioles and Seagulls. Motors will have horsepower of 90 to 150.

It is proposed to show that aeroplanes are adaptable for rapid intercity transportation by business men, oilmen, cattlemen, ranchmen and sportsmen, especially to reach isolated places. As an example, a plane has been actively in use by an oil man who maintains his home here but makes frequent—sometimes daily—trips to Bakersfield oil fields. Another use made of the Curtiss Seagull type, sold by Mr. Diess to the Canners Fish Co., is to send out a seaplane to locate schools of fish and wireless the information to the fleet, which immediately puts out from Los Angeles and Long Beach harbors for the fishing grounds. Motion picture studios and film stars have purchased a number of planes both for professional and private use.

Bellanca in Omaha

Prof. Giuseppe Bellanca, who has designed a number of efficient aeroplanes, is now associated with the Omaha Aircraft Co., and is now engaged in the design of the Bellanca C. F. Monoplane, which will be an enclosed cabin machine with seating capacity for four passengers and pilot, with a baggage compartment with sufficient space for personal baggage.

R. E. Davis is the general superintendent of the company, and E. T. Richards is manager in charge of sales.

Trunk Lines in Air Foreseen Next Year

Pittsburgh.—Biplanes now under construction will carry passengers from this city to New York or Chicago in three and one-half hours, and will be operating within the next year, according to plans laid before the Pittsburgh Chamber of Commerce. Representatives of a West Virginia corporation having the planes built at Gloucester City, N. J., said the first plane would make its initial trip to Pittsburgh next month.

A site for a flying field in Pittsburgh, lack of which recently prevented the landing of a Fokker monoplane from Philadelphia, has not been selected, it was said, but Colonel John Jordan, former chief of construction of the United States Air Mail Service, will accompany other engineers here soon to inspect locations.

The speed of the new planes, it is announced, will enable passengers to leave Pittsburgh any morning, transact business in either New York or Chicago and fly home in time for dinner.

The new biplanes are to have a wing spread of seventy feet. Express planes will have a cargo capacity of one ton and the passenger planes will carry thirty persons. Express planes will be driven by Liberty motors of 450-horsepower and the passenger craft by twin motors of the same power.

The express lines are to be placed in operation first, to be followed by the development of passenger transportation. Six trunk lines projected include: From New York to Pittsburgh; New York to Chicago, Cleveland, Washington and Boston; Pittsburgh to Cleveland, Chicago, Washington, Cincinnati and Buffalo, with combination routes through the Middle West and to the Pacific Coast.

New York-Havana in 19 Hours

The Aeromarine Navy HS-2 six-passenger flying boat "Presidente Zayas" which left New York on September 23rd, arrived at Havana on September 25th, the actual flying time being nineteen hours and the distance 1,521 miles.

The flying boat made stops at Atlantic City, Beaufort, S. C., Miami, Fla., and Key West.

Those who made the initial trip were Miss Dona Moberly, Miss Gladys Carruthers, Mr. F. Lopez de Haro and Mr. Alegario Monte. D. G. Richardson and Richard Greisinger were the pilots.

A delegation from the Aero Club of Havana and representatives of the Cuban Government welcomed the craft when it arrived. The flight of the Aeromarine "Presidente Zayas" opens the Southern season of the Aeromarine Airways. The present schedule calls for the departure of two boats a month for Havana from New York City; this will undoubtedly develop into a weekly service before the first of the year. Last season the price of a flying boat ticket to Havana was $750. Today the fare has been reduced to $250 per passenger, which compares more than favorably with the railroad price which is around $140.00.

Under the new schedule it is possible for passengers to board an Aeromarine Flying Boat in New York in the morning; fly to Beaufort, S. C., the first day, transfer there the following morning to another boat which has been held in waiting and fly to Miami, where another transfer is made, and from there on to Key West and Havana, arriving in Havana the afternoon of the second day.

By railroad and boat a passenger does not arrive in Havana until the morning of the fourth day.

According to cable reports received at the Aeromarine office in New York City, all four passengers were enthusiastic about the flight and have avowed their intention to return to New York the same way.

Pilots Endorse Licensing

Kokomo.—Federal licensing of pilots after rigid examinations was proposed at the Congress of Aviators September 22, attended by more than one hundred pilots from flying fields throughout the United States. Necessity for strict regulations for flyers was pointed out in an address delivered by R. W. Schroeder, holder of the world's altitude record.

Planes Are Used to Get Jobs for Idle

Philadelphia.—Business and industrial men of Philadelphia were having visualized to them September 15 the unemployment situation in this city—from the air.

To impress the leaders of commerce and industry here with the necessity of finding jobs for the jobless, the industrial relations committee of the Chamber of Commerce began flights with business executives here to show them the idle plants and industries in this city.

Idle freight cars in railroad yards, smokestacks from which no smoke is coming, mill yards in which there is no activity and other examples of unemployment are shown in the flights.

This is all in line with the adoption at a recent meeting of the industrial relations committee of the chamber of a resolution, which was signed by fifty-four business and industrial executives of the city, pledging themselves to seek jobs for the idle.

The Chamber of Commerce announced that in a few days aeroplanes will visit Washington, New York and Pittsburgh to deliver to those places copies of the resolution adopted here.

THE EFFECTS OF STAGGERING A BIPLANE

By F. H. NORTON

Langley Memorial Aeronautical Laboratory

(Technical Note of the National Advisory Committee for Aeronautics)

Summary

THIS investigation was carried out by request of the United States Air Service at the Massachusetts Institute of Technology wind tunnel in 1918. As the data collected may be of general interest, they are published here by the National Advisory Committee for Aeronautics. The lift, drag, and center of pressure travel are determined for a biplane with a stagger varying from +100% to —100%. It is found that the efficiency and the maximum lift increase with positive stagger. With large positive staggers the center of pressure is far forward and has a very slight travel with changes in lift coefficient.

Introduction

As staggered biplanes have certain advantages from the point of view of visibility, it was thought that a more complete investigation of the aerodynamic effects of stagger than had been done before would be of considerable value. Particular care was taken to examine the pitching moments of the various combinations, as they showed very interesting characteristics.

The references to work already done on stagger are given below:

Some Stable Biplane Combinations, J. C. Hunsaker;
British Advisory Committee R. & M. No. 196;
Nouvelles Recherches sur la Resistance de l'Air et l'Aviation, Eiffel.

Methods

The wings used in this investigation were an aluminum U.S.A.15 section as an upper wing, and an R.A.F.15 section as the lower. Identical sections were not employed, as none were available, but the two sections used had very similar properties, and previous tests have shown that the individual properties of the wings have little influence on the biplane characteristics. When comparing the biplane with the monoplane the average of the two wings was taken as the monoplane value. The characteristics of these wings are shown in Fig. 1.

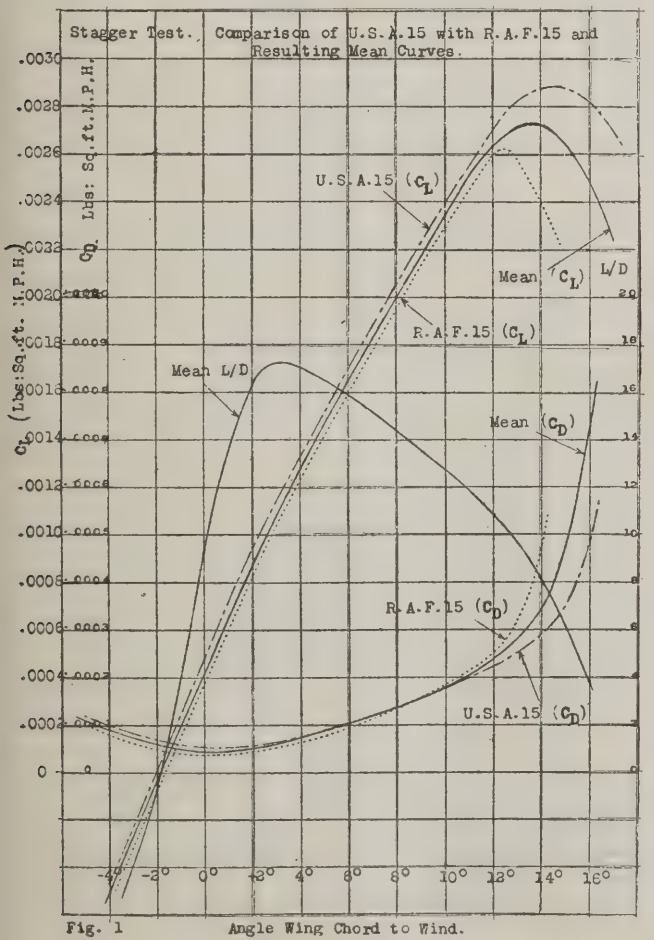


Fig. 1

The wings (3" x 18") were supported at the lower end by a streamlined cross bar which was attached to the N.P.L. balance spindle. The upper ends of the wing were connected by a very light strut whose resistance was carefully determined for each case. The gap chord ratio was one in all cases. The speed of test was 13.4 m.p.s. (30 m.p.h.).

Precision

The wings were lined up in each case to 0.05°. In every case three separate runs were made, resetting the wings each time. In nearly every case the reading checked within 1%, so that the average may be considered correct to better than this amount. It was necessary to obtain this rather high precision as the differences between different cases were generally small.

Results

It was thought most convenient to plot C_L, C_D, * L/D and C.P. against stagger for each angle of attack (Figs. 2, 3, 4, 5). The effect of stagger is clearly shown by these curves and needs no discussion. For the use of the designer, correction factors to change monoplane values to those of a staggered biplane, are given in Table 1.

* C_L = Lift, L; absolute coefficient = $\frac{L}{qS}$ $q = \frac{1}{2}\rho V^2$; S = area; V = True air speed; ρ = Density (Mass per unit volume)

C_D = Drag; absolute coefficient = $\frac{D}{qS}$

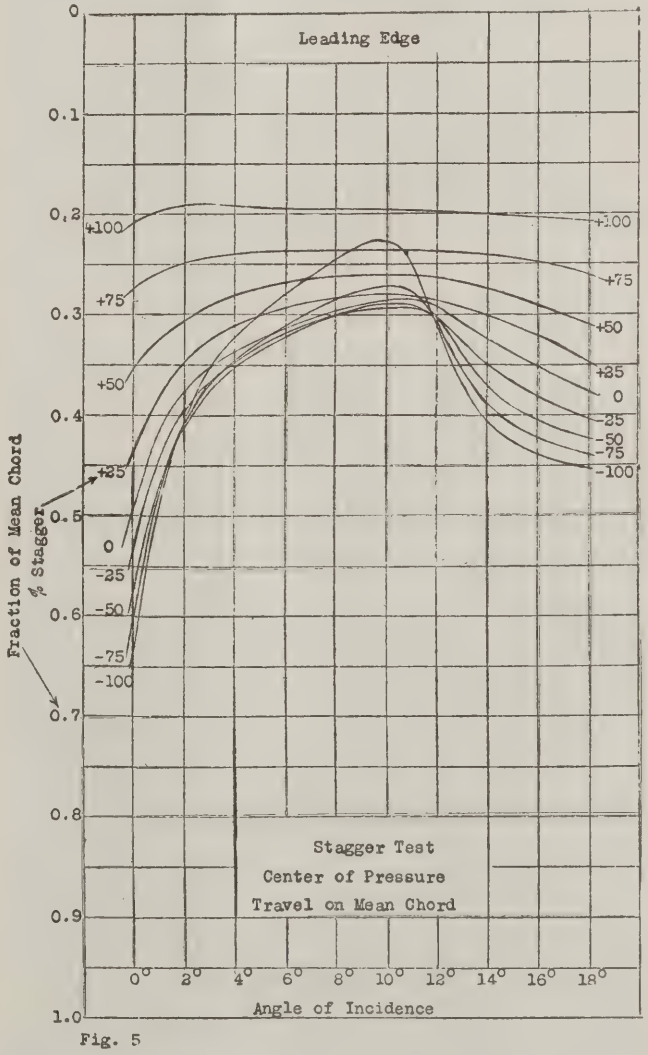


Fig. 5

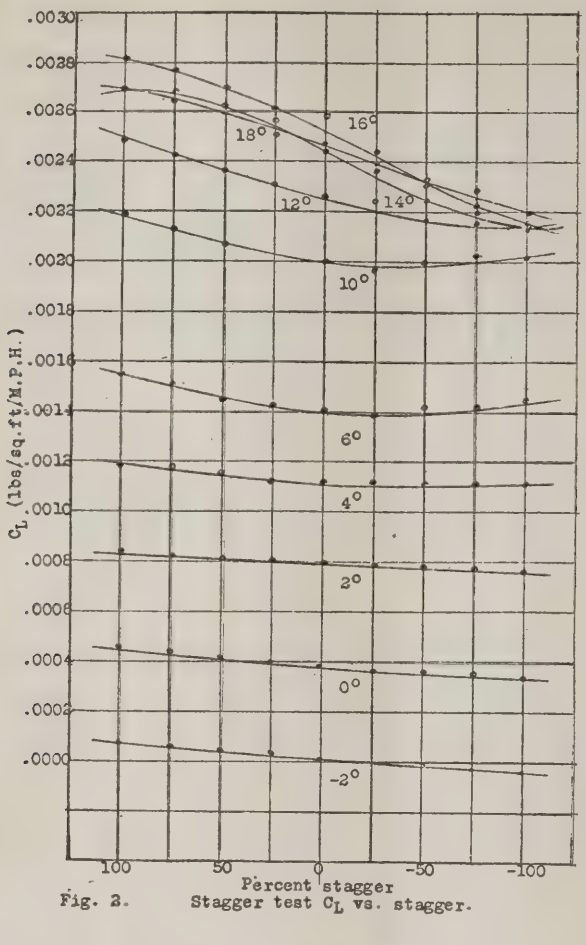


Fig. 2. Stagger test C_L vs. stagger.

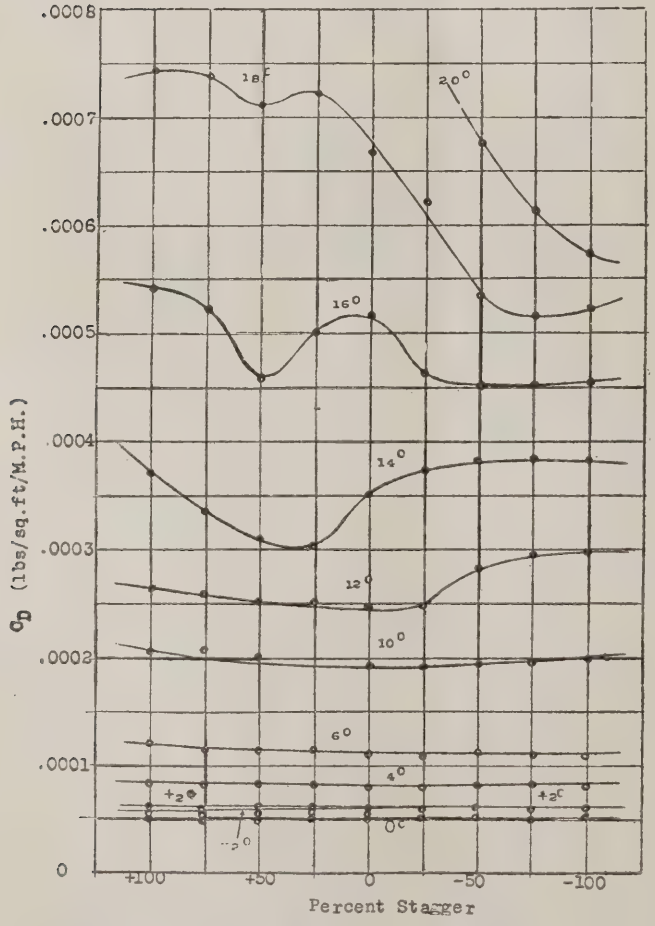


Fig. 3 Stagger Test C_D vs. Stagger.

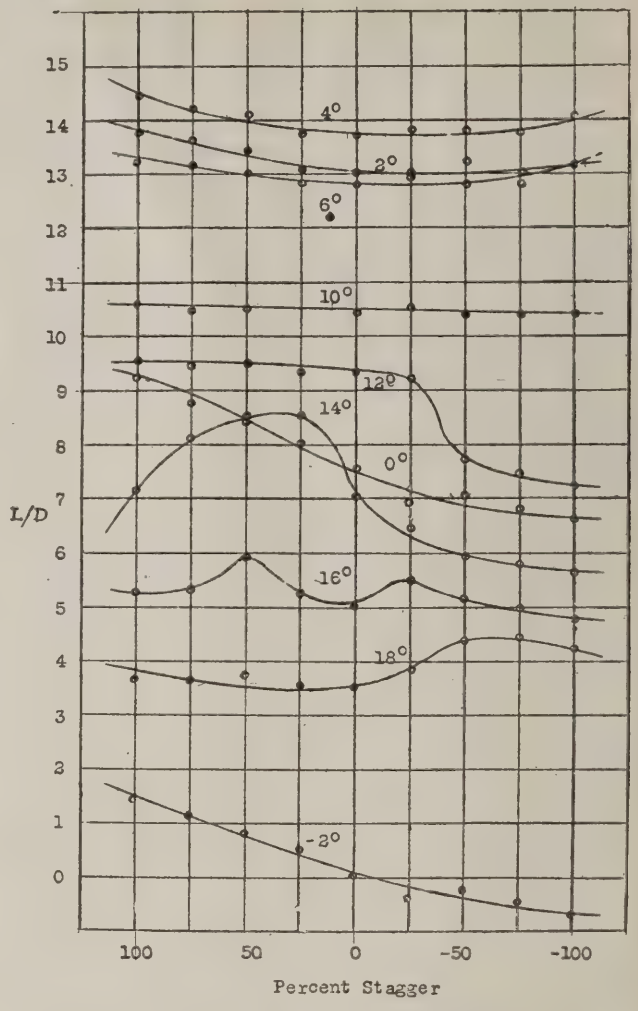


Fig. 4 Stagger Test L/D vs. Stagger.

TABLE 1.

CORRECTIONS FOR STAGGER

(Monoplane values to be multiplied by these factors)
Gap/chord ratio is one.

LIFT CORRECTIONS

1	+100%	+75%	+50%	+25%	0	—25%	—50%	—75%	—100%	1
—2	1.75	1.25	1.00	.50	.25	—.25	—.50	—.88	—1.35	—2
0	1.07	1.00	.95	.91	.86	.81	.79	.76	.74	0
2	.93	.92	.90	.89	.88	.88	.87	.86	.85	2
4	.92	.91	.89	.87	.87	.86	.86	.86	.86	4
6	.93	.91	.89	.87	.85	.84	.85	.86	.87	6
8	.93	.91	.89	.87	.85	.84	.85	.85	.87	8
10	.93	.91	.89	.87	.85	.85	.85	.85	.86	10
12	.94	.92	.89	.87	.85	.84	.82	.81	.81	12
14	.99	.98	.96	.92	.88	.85	.82	.80	.79	14
16	1.13	1.11	1.09	1.05	1.01	.97	.93	.89	.86	16

L/D CORRECTIONS

—2	—2.24	—1.57	—1.00	—0.57	—0.14	0.28	0.56	0.90	1.00	—2
0	0.98	0.94	0.90	0.85	0.80	0.75	0.73	0.72	0.71	0
2	0.85	0.84	0.83	0.81	0.80	0.80	0.80	0.81	0.82	2
4	0.85	0.83	0.82	0.81	0.80	0.80	0.80	0.81	0.82	4
6	0.84	0.83	0.82	0.81	0.81	0.82	0.82	0.82	0.83	6
8	0.84	0.84	0.83	0.82	0.82	0.82	0.82	0.82	0.83	8
10	0.84	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	10
12	0.86	0.86	0.86	0.85	0.84	0.83	0.70	0.66	0.65	12
14	0.89	1.00	1.05	1.07	0.88	0.80	0.75	0.72	0.70	14
16	1.57	1.60	1.78	1.57	1.52	1.65	1.54	1.50	1.42	16

Conclusions

This test shows that it is advisable from the point of view of aerodynamic efficiency to use the highest possible degree of stagger. Moreover, a positive stagger greatly restricts the center of pressure travel, thus simplifying the problem of stability.

DURALUMIN: ITS PROPERTIES AND COMMERCIAL POSSIBILITIES

By WILLIAM B. STOUT*

A MATERIAL one-third the weight of cold-rolled steel yet with the same approximate strength characteristics; a metal which can be heat-treated to higher physical properties, yet by a process which does not take effect for an hour after treatment; a possibility for much lighter and at the same time cheaper production in certain lines of manufacture; and in a few words you have a picture of the future possibilities of the new copper-aluminum alloy known as "duralumin."

Receiving its first impetus in the development of aircraft abroad, and particularly by the Zeppelin firm, this metal has been perfected in this country to a point far ahead of the German product, while the work in aircraft of both the airship or lighter-than-air type, and aeroplane or heavier-than-air machine, has developed processes and methods now applicable to new lines of production.

The new alloy can be rolled into sheets or forged by hand press or power hammer. It can be cast, welded and soldered, while rivets of the same material used with it show new production possibilities on account of the peculiarity of the heat treat resultants. Connecting rods have been made of it, using the metal itself for wearing surface without anti-friction metal. These have operated successfully in both motor cars and aircraft engines. Worm gears have been used made of "dural" as it is colloquially called, and used in heavy truck service successfully against steel pinions. Timing gears of this metal show new possibilities of both wear and quietness, but the most use has been in structural shapes for ultra-light constructions. The metal itself costs about five times as much as cold rolled steel per pound. For production work, however, remember that but one-third the number of pounds is used for the same strength result, while the material being much easier to work than steel in most of its forms saves materially on labor tool cost and tool depreciation, and on enough production items so that in many cases constructions can be made cheaper of duralumin than of steel.

The work we have been following has been entirely along the line of minimum weight structures of fairly large size for aircraft work. The saving of a pound in an aeroplane structure means the addition of a pound of fuel in flight or a pound of pay load, so that in aircraft more than anywhere else minimum weight is a vital item. Strength is, however, no less fundamental, as an aeroplane in flight at speed it subject to stresses far greater than those imposed on an automobile on the road or any form of present transport. Imagine having to build a motor truck of two-ton capacity that could run across a ploughed field at 70 miles an hour without breaking up. This alone would be some engineering problem, yet some modern planes of the bomb-carrying type are designed to do and do do this.

Structures are now being built of duralumin which far exceed former strength figures in wood and yet which are lighter than any previous wood-and-cloth aeroplane constructions. We have at present in process machines capable of carrying twenty passengers at two miles a minute for five hours, and fitted with six hundred horsepower engines, yet the whole machine weighs but the same as a Cadillac touring car. The entire secret of the weight result is of course not all in metal, but it is safe to state that the light weight figure could not have been reached with our present knowledge with any other known material.

Many have preferred steel in their experimental aircraft work on the basis that steel in tensile strength was stronger than dural even weight for weight. This is so, but the problem of strength in a structure is not ordinarily of tensile possibilities but of column or compressive strength.

For the same weight, duralumin has about three times the thickess of even cold-rolled boiler plate counterpart, and five or six times the section of alloy steels of high tensile. The rigidity of a sheet is dependent on its thickness very largely, and while dural is a much more flexible material than steel in equal sections, yet with the greatly increased sections used for equal strength a much greater rigidity is obtained than with steel.

For example, we have produced a rolled section, designed for a maximum column strength, and yet of such shape as to fit production requirements. This section of .035 thickness of metal in a 19-inch column length weighs 7½ ounces and will support as a column 4 tons plus. If made of steel of high alloy, its thickness would be, so far as tensile requirements go, about .009, a too great fragility to be trustworthy in a structure on account of the lack of rigidity of such a thin wall.

Duralumin, as we see it, looks very like aluminum except that it takes a high polish, and that when polished the glinting red of the copper in the alloy can be detected.

The polish in ordinary atmospheres is permanent, the metal being non-corrosive to a very high degree. In the tempered state it is almost impervious to salt spray, though in the annealed form salt water affects it.

The chief difference between this and previous aluminum alloys is its property of having its physical characteristics materially changed by proper heat-treatment. This heat-treatment in itself acts differently than with other metals, leading to some peculiar production possibilities.

Like all new things, this metal with its peculiar properties has certain assets and definite liabilities, but even its liabilities, in some cases, can be termed a profit, provided the structures made of the metal are designed to fit the peculiar requirements of the alloy.

The most marked difference in the metal is that the change in physical properties following heat-treatment is not instantaneous but very gradually rises to a maximum after about four days, and during this period not only is the tensile strength increased as high as 50% or more, but the elongation increases from 600% to 800%. More than this, the metal in its heat-treated form can be re-heated and softened for passing through mechanical processes not of too violent a nature, and at the end of one hour come back to its original tempered characteristics. The fact that the extreme properties of the metal are not reached immediately, as in most metals, is of great advantage commercially, as will be explained later.

The heat-treatment of the metal, or tempering, as it might be called, consists of heating the metal to 920-940 degrees Fahrenheit for from 7 to 30 minutes, the time being governed by the amount of metal in process. The material is then quenched in boiling water. It is then removed from the quenching bath and worked upon as soon as possible. In from one to two hours' time enough hardening will have taken place so that it will be difficult to work the metal. Where the time involved in making up the piece does not exceed one hour and where the bendings or hammerings are not too severe, this process is a thoroughly feasible production method.

This allows us in our aeroplane work, for example, to heat-treat a coil of sheet metal in a bath of sodium and potassium nitrates, quenching in an adjacent tank of boiling water and uncoiling the sheet or strip, start it immediately through the rolls which form it into the shape desired, having our complete process over and the spar ready for aging within 20 minutes from the beginning of the operation.

It is not my intention to go into any of the technical details or metallurgical study of the scientific side of this new alloy, but rather to point out the numerous possibilities opened up by its use and to describe and explain some of the results and processes now being obtained with duralumin, primarily in aircraft work. I will only state that the metal itself is nothing other than a copper-aluminum alloy, the copper running about 4%, and some magnesium, but with zinc as the most detrimental component. For this reason, duralumin is made only from the purest 99% aluminum, so that the impurities in each of the alloys from which the metal is formed will not build up a detrimental quantity. It is the inability of the Germans to obtain pure aluminum which has hindered their duralumin alloy from equaling the figures obtained in every-day production from the American product.

The metal itself, however, was developed in Germany from an original French laboratory development. The first real commercial use to which it was put, so far as the public was concerned, was in the metal ships of the Zeppelin Company. One of the reasons for the slow development of the Zeppelin, aside from the problems of airship design itself, was the necessity of developing the metal along with the structure, and it is certain that the material, unless rightly handled, has as many idiosyncrasies as a New England spinster, as well as being as temperamental as a coloratura soprano from Grand Opera.

In the early metal considerable trouble was had with corrosion and with sheets, seemingly without reason, granulated, and until the properties and difficulties were worked out, structures built of the material were more or less uncertain and required frequent inspection. This is still true in very thin gauges which are not very carefully heat-treated, but with pieces of any real section, corrosion is now an almost unheard-of thing.

In the following outline I will give merely our own experiences with the present liabilities of the material and things to be watched out for in its use, but in criticizing I would, at the same time, state my belief that duralumin and derivatives which will spring from it will form undoubtedly the mainstay of all future light-weight developments in automotive and kindred

* Paper presented before American Society for Heat Treating, Indianapolis.

structures, and that the use of this metal will grow by leaps and bounds as its marvellous advantages in both structure and production become very generally known and understood.

The main trouble had with duralumin is more or less similar to the problem met in other alloys, that is, the presence of impurities in the ingot, or air bubbles, small in their original forms, but which, when worked out and forged into thinner sections developed into serious defects.

Most of our material is of .035 stock, so that a very small speck of dirt can make a serious flaw in the metal sheet and a very small air bubble can make considerable pipe in the center of the sheet, almost impossible to find except by microscopic examination, added to considerable good luck.

Most of these flaws do not show up until after the rolling. In this case the greatest stress on the metal in putting it through the rolls is at a hidden point, so that to inspect these spars or chord members a dental mirror is used with a high light, and the surface very carefully examined. Frequently a hole as small as the point of a fine needle can be opened up into a flaw five inches long—a sort of stratification of the metal resulting from original ingot impurities.

At the beginning of our work, spar rejections, for this reason, ran as high as 400%, this gradually being reduced, and it seems possible in the near future that our rejections will be normal. In all these sections there has been no attempt at drawing the metal, but merely bending it, as any attempt to draw the metal results in an extreme number of rejections through cracking. It is peculiar that these cracks may not appear until a number of hours after the piece is made, so that after rolling four day is allowed to elapse before parts can be inspected for cracks or flaws, or before any piece is allowed to be put into the actual aeroplane structure.

In the design of the rolls also great care must be taken against too great a degree of draw between annealings, and that all radii are of sufficient amplitude for the metal.

The great drawback of the material as we are using it at present is the presence of ingot flaws, rolled out in the sheet, which lead to a very high rejection cost. When this is cured, we can say, I believe, that the experimental stage of duralumin is over. As soon as quantities of the material are demanded also rolls can be put in for greater widths of sheet than at present available—sixteen inches being now the best obtainable—and tubing and other structural forms can be made available.

I believe that this material, and developments from it in better alloys, will eventually be more universally used than steel for structural requirements. Its use in aeronautics is already definitely established, new as its use is, and the all-metal plane already given preference to the older types. I believe we will next see it in motor cars, at a saving of over half the weight, and in boats and busses, street and railway cars, bridges and girders. For the time being, however, it is a material to watch and study, and to make use of conservatively in conservative lines of engineering.

Composition:

Copper	3.50 to 4.00%
Magnesium	.2 to .75%
Manganese	.40 to 1.00%
Aluminum (99% pure)	Balance

Physical properties:

Specific Gravity	2.80
Weight	102 lbs. per cu. in.
Melting Range Centigrade	540 to 650
Compressive Strength tempered	44,000
Shear Value tempered	30,000
Tensile Strength tempered	50-60,000
Percent elongation tempered	16 to 20%
Modulus elasticity	10,600,000
Coef. expansion	.00000226 per degree C.
Yield Pt.	30,000

THE NEW AGE

By C. A. WRAGG

THE statement that this is a new age is so often heard that it has perhaps become hackneyed. In view of the prevailing conception of the universe as a growing organism it may be said that every day is the beginning of a new age. But it is interesting to observe how the human spirit is slowly yet surely extending itself—as from a center along every radius of activity—discovering natural laws, and irresistibly demonstrating, in physics, mechanics.—in every science and art, its ever widening control over the phenomenon called matter.

In the course of time this mastery has risen high in one field, then in another. We have evidence of ancient Greek art in sculpture which has not been surpassed. The Roman power of reasoning applied in law is the basis of all modern methods of dispensing justice. And it is not known to what extent the still more ancient races had mastered the science of astronomy and of the effect of the changing relations of the astral bodies on the earth and its inhabitants.

From the beginning each outburst of power has in its turn slumbered, only partly awakening perhaps centuries later to stir fitfully in a different field from that of the previous awakening; and the succeeding eras. denoted by the terms Stone Age, Bronze, Iron, Steam, etc., may be considered as chapters in the history of man, each one indicating the substance or discovery by means of which the races of the period lifted themselves to a higher state of civilization and accomplished the greatest amount of self expression.

The present epoch is so rich in discovery, and the factors which will determine its character are in such a state of flux, that it may be opportune to speculate for a moment on what the distinguishing adjective of this age is likely to be, and why, with a view to ascertaining whether the matter can be intentionally resolved. It might be called the Electrical Age, the Wireless, Mechanical, or Chemical Age, according to the viewpoint, as such great strides have been made in all of these fields. Yet, the criterion being that which will render the greatest service to man in his struggle for universal peace and happiness, it is considered by the writer that if it is to be given any specific term it should be called the Aerial Age.

The settlement of this question depends upon two conditions: 1st, the degree of skill required for production and use; 2nd, the quality of the reaction when used, that is, the influence on the minds of people. Now, a well-designed aeroplane is "a thing of beauty and a joy forever" to those with eyes to see; there is in it a thesis—a harmony of proportion. And it is correspondingly difficult to draw, that is, pictorially rather than by the mechanical presentation of the draftsman. Its production is an art and involves a careful coordination of the fundamentals of physics and mechanics. It depends so much on scientific construction for successful flight even when unburdened by the quality of commercial usefulness that unscientific production is virtually impossible. Mr. Ford proposes to revolutionize the railway locomotive principally by the scientific reduction of the size of parts; but a locomotive is statically supported by rails, and such a structural condition could never arise in aeroplane design because the aeroplane is dynamically supported at the expense of its own carrying capacity, which necessitates so much greater fineness at all times in the matter of securing maximum strength with the minimum of weight. There is a very narrow track between the treacherous waters of structural weakness on the one side, and the morass of reduced load-carrying power on the other. The laws governing the degree of inherent stability and controllability to be embodied in the design are equally if not more exacting. Aeronautical engineers and aviators in general see a new significance in the two bibical statements which refer to the straight and narrow way and to the difference between the quick and the dead!

To pass on to the second condition of the influence on the minds of people and the quality of the reaction: It should be realized that tremendous civilizing and wealth-producing forces are released by the full utilization of such a time-saving device as the aeroplane—forces which are subtle and hidden, but nevertheless as potent and active in their relation to national health, wealth, and strength as sunlight and air are to the body of the individual. It is well-nigh impossible to describe the net results of a nation thinking of transcontinental journeys in terms of hours instead of days.

It is also difficult to fully convey the beneficial effect and the great comfort of air traveling, with the consequent enlarged vista. When flight at great heights is experienced there are constructive influences which begin to work in the minds of people in spite of themselves, and often in a way that is hardly perceptible to the consciousness. They look from the new viewpoint at the highest structures on earth dwarfed into insignificance; they take in a whole city at a glance and look beyond at the farms, seemingly no distance away, the buildings like dolls' houses, the cattle almost invisible, and the trees and spaces combining to form a beautiful mosaic; they feel the faint soothing throb of the engines; they become quiet and meditative, and "the trials that infest the day, fold their tents like the Arabs, and as silently steal away." They experience what they may never have had before, sleeping or waking—what their medical advisers may have struggled in vain to give

them—complete relaxation. The soul is elevated and rests in the assurance of a larger fellowship than has ever before existed on earth. Such conditions and viewpoint are perhaps the best that could be contrived for the germination of the ideas that lead to the unity of races and to individual and international peace.

Thus, as the degree of constructive use of aviation constitutes a phycho-physical barometer, it is gratifying to note that since the war aerial transportation is becoming a bona fide agency of commerce. Australia has a mail service operated by the Gevernment, and several large companies have been formed for commercial air transportation. All Europe is awakened to the value of civil aeronautics. The London-Paris Air Express is particularly successful, and in a recent competition in Germany men floated about for more than five minutes at constant altitude without an engine, in gliders having deeply cambered wings, by means of which they were able to utilize the principles of wheeling and velocity soaring, covering a distance of over two and a half miles and sometimes circling twice over the heads of the onlookers. Man has become in fact a true rival to the soaring birds such as the eagle, the albatross. the buzzards of India and other great kings of the air. In the United States there are many aircraft companies operating in the regular business of transportation and passenger carrying. Beside the well known uses of sightseeing and the very successful work of the Post Office in the carriage of mail, there are enough other uses to make their recital wearisome. It is reported that one of the latest companies to be formed for passenger work will soon be carrying passengers between Washington and New York at fares approximately that of the railway; the journey will be done in one-third of the time and with so much greater comfort as to be incomparable. Flying is so safe that it is recorded that during 1920 considerably more than fifteen million miles were flown, and many tons of freight carried, besides 225,000 passengers.

Yet it is obvious that hardly the fringe of the great sureties of aerial commerce has been scratched. It can almost be said that the World War was the price paid for the establishment of aviation, which is not yet beyond its infancy. It was of course used as a destructive weapon, but it is written that every destruction is followed by a construction, and in order to justify the price paid it is surely incumbent upon us to infuse more activity into the *commercial* aerial program. The potential capacity and power of the United States in this respect are awe-inspiring, and the fact that we are so far comparatively inhibited is regrettable and inexcusable. The industry probably feels that it is determined by Congressional action, or rather, inaction; Congress may think that it should depend upon the initiative of the public; whereas, the fact is that all three should feel that urge of enlightenment and progress of which the flying machine is merely a concrete expression—a symbol, and cooperate to the limit. Let there be a Department of Civil Aeronautics under a single civilian head having piloting experience, with power to leave no stone unturned, literally as well as figuratively, in the laying out of numerous fields on every proposed highway; let the fundamental problems of the rights of way and of licensing machines and pilots once be definitely resolved, then bankers will open their coffers, the public will as a result quickly become familiarized with the sturdy practicability of aerial transport, and the industry can be relied upon to supply the finest machines. There is no doubt that any man who could be considered for the job would in the nature of things have sufficient imagination to be fired with a zeal for aerial possibilities that, whatever mistakes were made, would redound more to the interests of progress than the present indefiniteness.

Commercial aerial progress is inevitable. It is simply a question of whether a nation shall be positive, marching in the vanguard, exercising its full capacity like a real vertebrate, or, by lack of vision and true perspective, so dilly-dally as to bring about the negative condition of being ignominiously kicked into—the Aerial Age.

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

Alabama

The southern part of state, south of a line running east and west through MONTGOMERY, for the most part level, open country and many large fields. Good flying country, although very muddy in wet weather.

The southeast corner of state, although there are many large open fields, a great many of them have not been stumped. North of a line running east and west of MONTGOMERY the country gets rough. Much timber and only few open fields. Very mountainous around BIRMINGHAM district, very few open fields.

From MONTGOMERY, ALA., to SHELLMAN, GA., flat country, plenty of emergency fields.

From MONTGOMERY to DEMOPOLIS, MISS., via SELMA, UNIONTOWN. To Selma, timber strips, chop hills near Montgomery, to level near Selma, river and more timber. Safe at 3,500 feet. To Uniontown, safe 2,500 feet, farm patches, timber strips, thence to DEMOPOLIS, safe 3,500 feet, more timber (the same applies to Dempolis to Meridian, only more timber Meridian, and Meridian to Vicksburg, only hilly and rough with timber upon coming within twenty miles Vicksburg, Miss.).

MONTGOMERY to COLUMBUS, timber, bad. Air all this section good. MONTGOMERY to BIRMINGHAM, same as Columbus, only gets rough and hillier, especially on trip made via Montvallo, out of road.

Alabama is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done over this country, although swamp land is extended over a great deal of territory.

Alabama is open but very marshy along the water—appears to be floating bog, 3 to 4 miles back from water is woods and no chance. One could work from New Orleans to Mobile quite safely by following the Gulf—no beaches here.

Arkansas

TEXARKANA to LITTLE ROCK, timber, leveler near Texarkana than approaching Little Rock, which is rolling, with less timber, not many landing places in Little Rock section.

LITTLE ROCK to LONOKE, timber, few landing places. LONOKE to ENGLAND, safe altitude 2,500 feet, oil bumps, slightly rolling, timber patches. Air extra good. LONOKE to STUTTGARDE, the same, more timber, leveler. LONOKE to MEMPHIS, as above first forty miles, more timber, then country gets hillier, fewer landing places, some places none. Then upon approaching Memphis less timber, few farms, country fairly rough.

Arkansas is very bad. Swamps and rice fields, which are always dangerous landing places in the eastern and southern part, and the Ozark Mountains in the west and north are none too good.

Arkansas is very hilly.

California

Southern California (around San Diego), open country, ground clear, plenty of good landing fields.

At present there are only two well-established routes in Cailfornia: The San Francisco-Reno line and the San Francisco-Los Angeles-San Diego line.

Most of California is good. In making cross-country trips in this state one need only to follow the valleys to have good landing fields. Only a few mountains need be crossed to reach any point in the state.

There are two or three ways a plane could go from CRESCENT CITY to SACRAMENTO, CAL., and there are none of them that have too many places to land. The best route is:

Leaving Crescent City, follow the coast south to EUREKA (104 miles by road). At low tide it would be possible to make a forced landing most any place on the beach except two places, one about fifteen miles long and one about ten miles, and there are a few scattering fields on the way, then east across the Coast Range to REDDING or RED BLUFF (164 miles by road) very few landing places en route, and those where a forced landing could be made very undesirable, then south down the Sacramento Valley to Sacramento, where one could land most any time with safety.

The territory between STOCKTON and SACRAMENTO, SAN FRANCISCO and FRESNO: From Stockton as far north as MARYSVILLE, by way of Sacramento, and as far south as Fresno, is the safest possible territory for a pilot to cover in cross-country work. Flying at an altitude of 2,000 feet, the pilot has under him possible forced landing places all the time—places where he could set his ship down with a dead motor without serious mishap. Land is generally flat, crops are hay, grain, alfalfa, untilled pasture. Where there are vineyards enough hay or alfalfa land is interspersed to give the pilot considerable security even at this low altitude. One can land at or near the following towns: Marysville, Auburn, Thornton, Lodi, Galt, Escalon, Tracy, Modesto, Manteca, Madera, Herndon and Fresno. MODESTO now has a municipal landing field. From ROSEVILLE north-

east to AUBURN is dangerous country. Orchards and increasing mountains.

From STOCKTON west to SAN FRANCISCO or SANTA CLARA VALLEY the risk is somewhat greater, but flying at an altitude of 4,000 feet at the rate of 70 miles per hour it has been noted that there are just minutes when one would have to choose foothills, unpretentious mountains or peat land in case of a necessary dead stick landing. In regard to the "Delta Region" along the SAN JOAQUIN RIVER on the west side of the valley the soil here is good to land on in the later summer and fall, when the crops have been taken off. At all other times one is sure to nose over, as the soil is very loose and practically without bottom. There is, however, a permanent landing field now near THORNTON, of this peat soil, and by allowing it to pack, it is good the year round. The mountains between Stockton (or the San Joaquin Valley) and San Francisco are not high and there are numerous places in them where one could land with comparative safety.

There is a very safe civilian field in the SAN JOAQUIN VALLEY. It is completely surrounded by open territory, hay and alfalfa fields, and there is not a moment during an ordinary passenger flight when a forced landing could not be made without injury to passenger or pilot.

Fields around Los Angeles are:

1. Goodyear Field, located at Florence and Central Avenues, and Manchester and South Park Avenues. Very good condition. No aeroplane hangars there as yet, but Blimp hangar is located on west side of field. Field when fully completed will be one mile long and one-half mile wide.

2. Rogers Airport, located at Wilshire Avenue and Crescent Boulevard. Formerly known as Syd Chapman Airdrome. Good size field, about 8 or 9 hangars, and probably best known field here. Thoroughly progressive in every respect under management of Emory Rogers, Webster and Halliday.

3. Mercury Aviation Field, opposite Rogers Airport, about same size as Rogers, but not as well equipped with hangars.

4. Kinner Airport, located Long Beach Boulevard and Tweedy Road, good field and runway east and west, one hangar capable of holding three planes.

5. White Airport, located at South Los Angeles, Tweedy Road, good field and runway east and west, one hangar capable of holding three planes.

6. De Lay Field at Venice, large and has one big hangar capable of holding about six aeroplanes, located back from ocean about half a mile. Used extensively as test field.

7. Sierra Field, Pasadena, good location.

8. Pacific Field, located on Pico Boulevard near La Brea Avenue. Field has one hangar capable of holding two planes, and is large.

9. Daugherty Field, located at Long Beach, recently dedicated as Municipal Field and used in midwinter air tournament. This is without doubt best located field with view to future out here. Has big runway and northwest end runs into drainage canal, which later by dredging can be made into fine hydroplane landing canal.

10. Lattimer Field at Ontario, Cal., is long and narrow, being located between tracks of S. P. and Santa Fe Railways. Has ample runway to east and west, but only 200 feet wide. (Accident occurred there recently, evidently due to wash of passing train, passenger killed and pilot badly injured.) The railway is evidently a menace to flying from this field, but careful pilots could avoid menace of trains by proper flying rules.

11. San Bernardino Field, located opposite Urbita Springs Park, good take-off to west. This is about one-half way from San Bernardino to Colton. Only used occasionally. No hangars.

12. Redlands Field, class "A" field, being built by city. 1,800 x 1,800 feet, not used extensively as yet, but is rapidly being put in fine shape. Secretary Chamber of Commerce is live wire and backing it in fine shape.

13. Santa Ana, field in fair shape, about one-half mile south of city.

14. Corona, has fair field to south and east of city.

15. Pomona, field about a mile south from city, planted to alfalfa, only used occasionally, but has fine take-off and country is flat in that direction.

16. Torrence, Cal., has field to east of city south of main boulevard, has take-off to south, landings cross wind. Danger of over-shooting field, however, has been used a number of times. About quarter of mile from city.

17. Redondo Field, on main boulevard, just south of Catalina Street, Pacific Aero Club used it some last year, field needs fixing up, is too sandy, and there is hazard of trolley line to west toward ocean. City has promised to fix it up this winter.

18. El Monte, has field just south of city, used occasionally. The Blue Bird Air lines have also operated at San Fernando, Axusa, Acton and Hemet.

19. Hemet Field, located on main boulevard about quarter of mile from city. Very good. Altitude about 1,800.

20. Newport, field is known as Townsend Field, and was used by naval fliers last summer. It is on main boulevard from Santa Ana, about five miles out of Newport.

As to the nature of the country, from Los Angeles to El Monte to Pomona to Ontario to San Bernardino to Redlands, is over flat country, an dthere are plenty of emergency fields at all points for forced landings. This is also true in flying west or south from Los Angeles. At Venice and Redondo, also at Newport and Balboa, the beach is always within reach for forced landings, and at low tide landings have been made on the beach at a number of places. This is also true of Long Beach. As one goes north from Los Angeles he has flat country as far as San Fernando and Sagus, the mountainous.

There is very little swampy land around Los Angeles, some south of Long Beach, and some south of Venice, but otherwise none that would amount to anything.

The physical hazards here are less than in any other part of the country.

Colorado

TRINIDAD to ELK CITY, OKLA., about the same, more farms and leveler on approach to Oklahoma line. TRINIDAD to PUEBLO, pretty rough, mountains north and west, some very bad places. PUEBLO to COLORADO SPRINGS, some very bad. High altitude, air light, mountains rough most of way, especially CRIPPLE CREEK section, west and east. COLORADO SPRINGS to DENVER, better, still rough.

Between COLORADO SPRINGS, COL., and CHEYENNE, WYO., a short flight of only two hours, is over flat country, with the exception of only a small range near Colorado Springs. All the territory east of DENVER is flat, and west of Denver mountainous, where landings might be made but with some difficulty.

The geographic condition of this part of the country is divided into two distinct districts: First—That part lying east of a line drawn through DENVER, COLORADO SPRINGS, PUEBLO and TRINIDAD. This country is practically one large landing field—rolling prairie, the greater part of it never having been broken, and the fences are few and far between. Second—To the west, however, there is mountain flying entirely, and while there are many parks and open places where it would be possible to land a ship in an emergency without very much damage, yet on the whole it is rather hazardous flying.

Connecticut

BRIDGEPORT, country around here is fair.

In the CONNECTICUT VALLEY REGION there are numerous good landing fields; country is very good on the whole.

From BRIDGEPORT up the Housatonic and Naugatuck Rivers to WATERBURY it is very poor flying country, fields being mostly on side hills and this is a very hilly and wooded country. In and around Waterbury it is very poor flying country—hills, small fields and woods. Slow landing planes may get in and out of some of these fields with skillful pilots. It is very difficult to find fields surrounded by other fields—a condition so much desired by pilots in case a motor quits on a take-off. To the east of Waterbury lies a valley formed by the Connecticut River from NEW HAVEN north. There are plenty of fair-sized level fields through here, around Meriden, Bristol, New Britain and Hartford.

From FRAMINGHAM, MASS., to Connecticut the country is rough and many woods cover the ground, along the Sound and Connecticut there are very many landing fields where a Jenny could land, and possibly a D.H.-4.

There are several possible landing fields in MIDDLETOWN, but not being along any flying route, this information is of little value.

From ROOSEVELT FIELD, N. Y., to DANBURY, CONN., across Long Island is good. Across the bay to NORWALK, CONN., and thence to Danbury, rather poor chance. Vicinity of Danbury rather bad and lots of hills.

From SPRINGFIELD, MASS., to BRISTOL, CONN., fairly good and excellent field there, but on proceeding to Danbury conditions become not so good, and hills increase.

Cuba

From HAVANA to SANTIAGO DE CUBA and GUANAMO the country is fairly good to fly over. There are any number of cane fields in which to land safely, but would necessitate dismantling the machine. There are many sugar mills scattered over the island and they all have some kind of a pasture that makes it easy to land.

Landing fields at the different towns of importance are:

Havana, Camp Columbia, military field nine miles southwest of town.

Cienfuegos, one mile northeast of town.

Camaguay, one-half mile northeast of town, U. S. Marine Field.

Santiago de Cuba, on water front west of town, only good in dry weather.

Guantanamo, one mile southwest of town near large hospital.

There are several other towns with fair landing fields, but they need fixing up a little. The ones named are in good shape and are taken care of, so they can be used any time, except the one at Santiago and a little rain will make a bog hole of it.

Florida

All bad country, except possibly central part or southern, near CARLSTROM FIELD. Good around ORMONDE BEACH.

Between SAVANNAH, GA., and JACKSONVILLE, FLA., it is all swamp land, extending inland 10 to 25 miles.

Florida (around Arcadia), both open and wooded country. Open country covered with palmetto bushes.

Florida, north of the EVERGLADES and FORT MYERS is safe for cross-country work. Landing fields are not abundant, but there are enough in case of trouble.

Florida makes a safe place for water planes. This does not include over ocean trips for long distances.

Georgia

Southern half of state level, open country. Many large open fields. Northwestern part of state, very few landing fields. Fields are terraced and are not stumped, making safe landing in case of motor trouble impossible.

Between SAVANNAH and JACKSONVILLE, FLA., swamp land extending inland 10 to 25 miles. From SAVANNAH north toward COLUMBIA, S. C., there is much marsh land and timber.

From SHELLMAN to AMERICUS, flat country, plenty emergency landing fields. Getting hilly toward MACON.

AMERICUS to MACON, landing possible anywhere from 3,000 feet. MACON to MADISON, few good fields on account of hilly country and terraces. Forced landing should be made between MACON and MADISON in dry weather. Between MADISON and ATHENS, very few fields (35 miles), good field ATHENS. ATHENS to AUGUSTA, practically no fields this strip, very bad hilly country. Good fields vicinity AUGUSTA.

AUGUSTA to COLUMBIA, S. C., no fields first 15 miles, good country last 60 miles. Good fields COLUMBIA.

ATHENS to ELBERTON, good emergency landings possible, hard to get away from on account soft land. ELBERTON to WASHINGTON, D. C., few fields except around TIGNALL.

WASHINGTON to ATHENS, practically no suitable fields. ATHENS to MONROE, good fields except in immediate vicinity around OCONEE RIVER.

ATHENS to ATLANTA, good landings first 20 miles, rest of route very bad, no possible chance to land except on field at ATLANTA, which is very bad. ATHENS to CARNESVILLE, no possible fields, hilly, awful country. ATHENS to SOCIAL CIRCLE, good fields all the way, good field at SOCIAL CIRCLE. SOCIAL CIRCLE to COVINGTON, not good country, but landings possible.

ATHENS to EATONTON, not good country, but landings possible. ATHENS to COMER, good fields in river pasture all the way. AUGUSTA to WARRENTON, landings possible all the way, cotton fields. AUGUSTA to LOUSVILLE, GA., good fields (cotton) large field LOUISVILLE. AUGUSTA to GREENVILLE, S. C., good fields to GREENSBORO, from there on country gets worse and is bad at GREENVILLE. No chance forced landings. From AUGUSTA to WAYNESBORO, good country all the way, flat.

Georgia is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

At SHELDON the land is flat and dry and landing fields are plentiful.

Illinois

Illinois (along Air Mail Route)—Flat country, but mostly given up to farming. Fields large enough but mostly plowed. Pastures usually the roughest land.

Central part of Illinois, radius 150 miles from CHICAGO, good.

The territory in the State of Illinois shows landing fields frequently, and very fertile for the aviation industry. The conditions prevailing here are excellent for flying.

The central portion of Illinois is practically all level country and would be termed good flying territory.

The route CLEVELAND-CHICAGO, of course, is very good, as it would be possible to pick a safe landing place at any time—the route is easy to follow and the mail has a good two-way field about half way. Martin Field at Cleveland is very good for any machine. The entire route CHICAGO-OMAHA is perfect for forced landings. Landmarks are good. The air mail has a fine field at IOWA CITY, IA., there is also a fine landing field on the north side of DES MOINES. The country from ATLANTIC, IA., to OMAHA is a bit rough, but from a reasonable altitude a landing could be picked without trouble. That is the regular mail route, but one could also follow the Burlington R.R.—CHICAGO to OMAHA. As far as the Mississippi River the country is perfect for landing, but from there until the Des Moines River is reached at OTTUMWA the country is rather bad, but with plenty of altitude a safe landing would be possible. From OTTUMWA the rest of the route is perfect.

All of Northern Illinois is excellent. CHICAGO to INDIANAPOLIS, IND., is good.

On the CHICAGO-CLEVELAND route, passing over BRYAN, OHIO, the land east from the Illinois line to a point ten miles east of GARY, IND., is swampy or with a scrub growth or sand dunes, unless swinging around more than five miles south of Lake Michigan. In the balance of the route over Indiana there are short stretches of territory of probably not over ten per cent of the distance altogether, on which a dead stick landing without damage would be difficult, but not impossible, due to rolling terrain and numerous groves. In OHIO, in the immediate vicinity of the MAUMEE RIVER, there is quite wet and soft ground during the rainy season. Within a radius of five miles of city limits of CLEVELAND the ground is quite difficult and fields very small. The weather across Indiana over the lakes region in particular is quite difficult during rainy seasons, but very rarely impassable, while the weather in OHIO has never been found impassable.

From CHICAGO to ST. PAUL, the ground is very smooth, ideal as regards flying, only scattered groves, but with the Mississippi Valley soft during wet seasons. This country is subject to heavy rain storms with low fog and clouds at times, but only rarely impassable.

From CHICAGO to OMAHA, over IOWA CITY, IA., the ground is very level with the exception of some very short distances in the vicinity of the Mississippi and Missouri Rivers. This country is subject to heavy rain storms with low fog and occasionally blinding snow storms and very cold weather in winter, but rarely impassable from these.

From CHICAGO to MINNEAPOLIS-ST. PAUL, over LA CROSSE, WIS., the route lies over fairly level and open territory as far as the Wisconsin River, from there on northwest the country grows rapidly rougher and with heavy timber till the last fifty miles out of La Crosse has only scattered possible landing fields. From La Crosse up the river valley or over the highlands to the west of river, possible landing fields are available from an altitude of two to three thousand feet. The territory from the Wisconsin River northwest has days when low fog and rain make it impassable, but these days are actually not numerous. In winter time this route suffers from very cold weather and blinding snow storms, but some of which are practically impassable.

None of these four routes mentioned suffer from prohibitive winds.

The route between MILWAUKEE and CHICAGO is almost ideal from an emergency landing field point of view. One route from MILWAUKEE to CHICAGO follows the C. M. & St. P. R. R. as far as RACINE, which is passed two miles west of the City Hall, KENOSHA is passed 2½ miles and WAUKEGAN 3 miles. Land at the Air Mail Field at MALWOOD, also known as the Checkerboard Field. All along the route there are many level fields which have ample landing facilities.

The best description of the territory about PEORIA could be described by saying that it is the center of the famous Corn Belt of Illinois. Within a radius of 150 miles any pilot with any reasonable amount of experience could pick an easy landing. Between PEORIA and GALESBURG the ground is flat. At GALESBURG the Caldwell Brothers have their field, where they conduct a school and do exhibition flying. Territory around CANTON, ILL. is O. K., likewise around BLOOMINGTON the landing places can be easily picked out. At PEORIA the Illinois River Valley is about two miles wide. Good landing fields can be found on either side. The width of the river here affords unusual facilities for flying boats and was used a great deal for this purpose last year. The AIRCRAFT CLUB here has recently leased a field which will be marked as called for by regulations and suitable hangar is being built. Visiting planes are welcome at any time.

Illinois is all good, except country from Franklin Co., south, including Johnson, Williamson, Union, Jackson Counties, which are very bad and dangerous to cross. In the N. W. corner in Jo Dowiers Co., it is very hilly and bad. The Air Mail Field at CHICAGO can be found—near the Station of Maywood—near big race track, north of drainage canal and along Desplaines River. Also near big cemetery—very good. Curtiss field—south of draining canal in big swamp—likely looking field.

NAVAL and MILITARY AERONAUTICS

Goodyear Airships Tested

The first test flight of the Army Airship No. A S 1504 was made at the Goodyear Akron Air Station September 12, by Flight Officer Lieut. G. W. McEntire. This airship is of the Goodyear Pony Blimp, or "AA," type. It has a gas capacity of 35,000 cubic feet, is 95.5 feet long, and has a maximum diameter of 28 feet. The car accommodates two or three passengers and is equipped with a Lawrence three-cylinder 50 HP motor, having a cruising radius of 450 miles.

This ship was manufactured by The Goodyear Tire and Rubber Company and assembled at the Goodyear Akron Air Station. It was flown by Lieut. McEntire to Dayton, Ohio, on September 19th, where it will be used by the Engineering Section of the Balloon and Airship Division for experimental purposes. A fabric hangar has been erected at Dayton to house the ship.

Fleet Air Force Gunnery

The Fleet Air Force on Sept. 2 commenced the annual gunnery exercises, consisting of eight practices per man for all pilots and men attached to the land plane divisions. Ground strips, towing sleeves and camera gunnery were included in the evolutions being carried out by the planes. Practices are expected to last until the latter part of October.

Immediately following the present practices the seaplane divisions will start the annual bombing practices, dropping live and dummy bombs at fixed and towed targets. It is thought these practices will last approximately one month.

Army Uniforms Not to be Materially Changed

Inquiries having reached the War Department as to whether or not there would be a return to the blue uniform, the War Department authorizes the statement that there is no present intention of making material changes in the existing uniform or additions thereto. Under existing regulations the blue uniform has been abolished; and the white and olive-drab uniforms being those authorized.

Minor changes authorizing a slit in the bottom of coat skirt and a hook on the coat to hold the Sam Browne Belt in place are in course of preparation.

Love Field Accident

Love Field, Dallas—Three aviators were killed in an accident here Sept. 16. James F. Armstrong was one of the men. The other two were named White and Gibson.

The plane went into a tail spin and the three men were burned to death. Armstrong was a lieutenant. White and Gibson were mechanics. They were from Fort Sill, Oklahoma.

Advises Air Force at the Philippines

London—Vice-Admiral Mark Kerr, in an article in the London *Outlook*, declares that the United States needs no huge

(*Continued on page* 111)

Reorganization of the Air Service at Reduced Strength

Orders are being issued by the War Department as follows:

1. That the following units be organized at the stations indicated:

Unit	*Place of Organization*	*Table*	*Permanent Station*
15th Squadron (Observation) (Reduced strength)	Chanute Field	873	Chanute Field
16th Squadron (Observation) (Reduced strength)	Fort Riley	873	Fort Riley
18th Squadron (Observation) (Reduced strength)	Rockwell Field	873	Rockwell Field
19th Squadron (Pursuit)	March Field	277	Oahu
23rd Squadron (Bomb'm't)	March Field	576	Oahu
24th Squadron (Pursuit)	Mitchel Field	277	Panama
25th Squadron (Bomb'm't)	Mitchel Field	576	Panama
26th Squadron (Attack)	Kelly Field	279	Kelly Field
28th Squadron (Bomb'm't)	Mather Field	576	Philippine Islands
Photo Section No. 3	Bolling Field	79	Bolling Field
Photo Section No. 5	Chanute Field	79	Chanute Field
Photo Section No. 8	Mitchel Field	79	Mitchel Field
Photo Section No. 9	Fort Riley	79	Fort Riley
Air Park No. 3	Langley Field	175	Langley Field
Air Park No. 6	Mitchel Field	175	Mitchel Field
Air Park No. 7	Mitchel Field	175	Mitchel Field
Air Park No. 8	Mitchel Field	175	Panama
Hdqrs. 1st Balloon Group	Brooks Field	177	Brooks Field
Gunnery Det. (See Note 24)	Carlstrom Field		Carlstrom Field
Branch Intelligence Office 11	Oahu	71	Oahu
Branch Intelligence Office 12	Philippine Islands	71	Philippine Islands
Branch Intelligence Office 10	Panama	71	Panama
Branch Intelligence Office 1	Mitchel Field	71	Mitchel Field
Branch Intelligence Office 2	Kelly Field	71	Kelly Field
Branch Intelligence Office 3	Crissy Field	71	Crissy Field
Det. Office, Chief of A. S.	O. C. A. S.		Washington

2. That when accommodations are available in overseas departments for units that are to be organized in the United States under paragraph 1 above, the Department Commander concerned will request orders for their transfer. The Commanding General, Panama Department, will make similar request when quarters are available for two balloon companies not mentioned above.

3. That the following units be demobilized:

Heavier-than-Air Det.	Camp Knox
Heavier-than-Air Det.	Camp Benning
Pilot School	March Field
Supply Detachment No. 1	Fairfield, Ohio
Supply Detachment No. 2	Fairfield, Ohio
Supply Detachment	Mather Field
" "	Mitchel Field
" "	Rockwell Field
" "	McCook Field
" "	Love Field
" "	Park Field
" "	Scott Field
" "	Souther Field
" "	Middletown, Pa.
Casula Detachment	Crissy Field
Stockkeepers School Det.	Fairfield, Ohio

4. That the following units be placed on the "Inactive List" under the provisions of Section II, G. O., No. 32, W. D. 1921, with "Active Associates" as indicated:

Inactive Associate	*Active Associate*
Balloon Co. No. 6	Balloon Co. No. 23
" 7	" 23
" 11	" 23
" 14	" 1
" 15	" 13
" 24	" 1
" 25	" 13
" 26	" 20
" 28	" 22
" 29	" 20
" 30	" 22
" 31	" 20
" 32	" 22
Headquarters, 2nd Wing (Observation)	Headquarters, 1st Wing
Headquarters, 7th Group	Headquarters, 1st Group

5. That the following named units be redesignated and reorganized where necessary in accordance with the 1920-21, Tables of Organization:

Old Designation	*New Designation*	*Table*	*Station*
1st Squadron (Observation)	1st Squadron (Obs.) (Reduced strength)	873	Mitchel Field
3d Squadron (Observation)	3rd Squadron (Pursuit)	877	Philippine Is.
5th Squadron (Observation)	5th Squadron (Obs.) (Reduced strength)	873	Mitchel Field
6th Squadron (Observation)	6th Squadron (Pursuit)	277	Oahu
8th Squadron (Surveillance)	8th Squadron (Attack)	279	Kelly Field
10th Squadron (Observation)	Air Park No. 1	175	Bolling Field
12th Squadron (Observation)	12th Squadron (Obs.) (Reduced strength)	873	Kelly Field
13th Squadron (Observation)	13th Squadron (Attack)	279	Kelly Field
50th Squadron (Observation)	22nd Squadron (Obs.) (Reduced strength)	873	Post Field
22nd Squadron (Observation)	50th Squadron (Obs.) (Reduced strength)	873	Langley Field
88th Squadron (Observation)	88th Squadron (Obs.) (Reduced strength)	873	Langley Field
90th Squadron (Surveillance)	90th Squadron (Attack)	279	Kelly Field
91st Squadron (Observation)	91st Squadron (Obs.) (Reduced strength)	873	Eugene, Oregon
99th Squadron (Observation)	99th Squadron (Obs.) (Reduced strength)	873	Bolling Field
Balloon Company No. 2	Balloon School	780	Ross Field
" " No. 3	Balloon Company (Coast Def.) No. 3	579	Oahu
" " No. 4	Balloon Company (Coast Def.) No. 4	579	Brooks Field
" " No. 5	Balloon Company (Coast Def.) No. 5	579	Brooks Field
" " No. 9	Airship Co. No. 9	580	Ft. Omaha
" " No. 12	Airship Co. No. 12	580	Ft. Omaha
" " No. 17	Balloon Company (Coast Def.) No. 17	579	Philippine Is.
" " No. 18	Airship No. 18	580	Aberdeen
" " No. 20	Balloon Company (Coast Def.) No. 20	579	Lee Hall
" " No. 21	Balloon Company (Coast Def.) No. 21	579	Oahu
" " No. 22	Balloon Company (Coast Def.) No. 22	Lee Hall	
" " No. 27	Balloon Company (Coast Def.) No. 27	579	Philippine Is.
Airship Co. No. 10	Airship School	Langley Field	
Headquarters, 1st Surveillance Group	Headquarters 3rd Group (Attack)	274	Kelly Field

6. That the following units or detachments be transferred as indicated, the change of station to be made by rail, marching, trucks or aeroplanes, depending upon which means is the cheapest, the commander concerned making the decision:

Unit or Detachment (*See Note* 1)	*Approx. Strength*	*From*	*To*
Airship No. 8	57	Camp Bierne	Brooks Field
91st Sqdn. (Obs.) (Red. strength) (See Note No. 2)	105	Mather Field	Crissy Field
2nd Group Bombardment) (See Note 3)	386	Kelly Field	Ellington Field
49th Squadron (Bombardment) Upon completion of present duty	128	Langley Field	Langley Field
96th Squadron (Bombardment) Upon completion of present duty			
Headquarters First Wing	12	Kelly Field	Kelly Field
Flight "B" 8th Sqdn. (Attack)	Name only	Camp Bragg	Kelly Field
Headquarters and Flight "A," 12th Squadron (Obs.) (Reduced strength) (See Note 4)	24	Douglas	Kelly Field
Flight "B" 12th Sqdn. (Obs.) (Reduced strength) (See Note 4)	25	Nogales	Kelly Field
88th Sqdn. Obs. (Reduced strength)	Name only	Langley Field	Camp Knox
Photo Section No. 7	Name only	Langley Field	Camp Knox
1st Sqdn. Obs. (Reduced strength) Upon completion of present duty	43	Langley Field	Mitchel Field
5th Sqdn. (Obs.) (Reduced strength) Upon completion of present duty	44	Langley Field	Mitchel Field
22d Sqdn. (Obs.) (Reduced strength)	Name only	Post Field	Montgomery
Photo Section No. 4	Name only	Post Field	Montgomery
Airship Co. No. 9	25	Omaha	Scott Field
Airship Co. No. 12	31	Omaha	Scott Field
Detachment	17	Ft. Baker	Ross Field
" (See Note 5)	20	Camp Lewis	Scott Field
"	68	Camp Lewis	Crissy Field
"	19	Eugene, Ore	Crissy Field
" (See Note 6)	50	Camp Benning	Lee Hall
"	46	Ft. Baker	Crissy Field
" (See Note 7)	56	Camp Benning	Montgomery
"	4	Park Field	Montgomery
"	26	Southern Field	Montgomery

(*Continued on page* 118)

(*Continued from page* 110)

battle fleet to defend the Philippine Islands because it can be better accomplished by use of air patrols in collaboration with destroyers, submarine chasers, motor boats and underwater defense craft.

His main contention is that the battle fleets cannot operate to advantage when so far removed from their home bases. He says further that in conversation with Admiral Sims he found the American Admiral in agreement with him on the future methods of naval warfare. With such a defense as he suggests, Admiral Kerr says of the Philippine problem:

"Mine fields and mine nets complete the equipment for preserving the sacredness of the sanctuary around the Philippines, a sanctuary which it will practically be suicide for an enemy to enter."

Petty Officers' Club

At a recent election held in the Aviation Chief Petty Officers' Club rooms at the Great Lakes Training Station, it was proposed to expand the club and to move it to the main station so that every chief on the station will be eligible for membership. Following the move, the club will be affiliated with the Chief Petty Officers' club that was recently organized on the Pacific coast.

The Late Capt. Minnis

Washington.—Captain John A Minnis of the Marine Corps was killed Sept. 22 while flying at the Marine Flying Field at Quantico, Va.

Captain Minnis was doing night flying to give practice to the Searchlight Battalion at the Quantico Marine Barracks. In VE-7 Aeroplane 5957, at an altitude of 3,000 feet, his machine was caught in a searchlight beam and Captain Minnis made a dive at a sharp angle to get away from it, a common practice. At an altitude of about 1,000 feet, Captain Minnis pulled out of the dive and observers got the impression that the plane from that time on was out of control. With the motor running, the plane struck water directly off the mouth of Quantico Creek. It is supposed that Captain Minnis used his motor in an effort to pull up the nose of the plane. His body was found in the wreckage of the plane.

Mrs. Laura W. Minnis, Captain Minnis's wife, was at the Quantico Hotel at the time of the tragedy, with her infant daughter. Captain Minnis's mother, Mrs. Maggie S. Minnis, resides at 211 Church Street, Montgomery, Ala.

Captain Minnis was born June 6, 1891, at Montgomery, Ala., was appointed to the United States Naval Academy in 1911 and upon graduation became a second lieutenant in the Marine Corps. He served in the World War with the Thirty-eighth Infantry and the Fifth Regiment of Marines. He was decorated with the Distinguished Service Cross for conspicuous bravery at Mesey on July 15, 1918, and was wounded in action on Sept. 15, 1918. He also received the Navy Cross.

Lt. Commander Douglas Married

Stamford.—Winifred Davis Moore, daughter of the late Mr. and Mrs. Samuel Todd Davis, Washington, was married to Lieutenant Commander Archibald Hugh Douglas, U. S. N., October 1, at the Caritas Island home of her sister, Mrs. J. Percy Bartram.

FOREIGN NEWS

The Next Paris Aero Show

It is now announced officially by La Chambre Syndicate des Industries Aéronautiques that the Seventh International Exhibition of Aerial Locomotion organized by this body will take place in Paris from November 12 to 27. No exhibition was held last year, owing to the depressed state of the aircraft industry. The fact that it has become possible to hold an exhibition this year indicates that the French aircraft industry is already on the upward path after the slump.

It is earnestly to be hoped that the British aircraft industry will be thoroughly well represented at the forthcoming exhibition. All foreign countries are now taking a lively interest in air transport, and, though actual orders may not be numerous in November next, those firms which have the courage to make a good display will, at any rate, have an opportunity of making a reputation for themselves which will have considerable influence on their order books in the following year. Paris is always the centre of any new movement, owing to its being so easy of access as compared with any other European capital, and also because it has no early closing laws.

All correspondence should be addressed to Monsieur le Commissaire Général de la Chambre Syndicale des Industries Aéronautiques, 9, Rue Anatole de la Forge, Paris 17e.

English Channel Statistics

An interesting comparison of crew and passenger personnel may be made in the statistics for the English Channel services for the week ending September 4, as follows: Machines, 103; passengers, 427; crews, 129; total personnel, 556. Corresponding week last year: Machines, 104; passengers, 219; crews, 129; total personnel, 348.

Air Line Developments in Czecho-Slovakia

Apparently Prague is making very appreciable progress as the center of a net-work of air transport services. There are already daily services linking Prague to Paris, Strasbourg, and Warsaw, and during the next few months it is believed that there will be services to Budapest, Belgrade, Bucharest and Constantinople, and to Dresden and Berlin.

In February last year when the Paris service started three passengers only arrived by air at Prague. In June the figure was 76. In February 16 lbs. of parcels and 3 lbs. of newspapers arrived by air. In June 7,000 lbs. of parcels and a ton and a half of newspapers were brought by air.

The figures of duty paid on goods arriving by air are instructive. They are: February 130 crowns, March 3,550 crowns, April 30,787 crowns, May 86,752 crowns, and June 207,104 crowns.

The Franco-Roumanian Air Navigation Company, who operate the Paris-Prague Service, have over 40 machines in service.

For the extension of the service to Constantinople a type of large multiple engine machine is being built at the Blériot works. This machine will, it is said, be of 1,200 h.p. and will have accommodation for 16 passengers and their luggage.

British Seaplane Dock Finished

The seaplane floating dock laid down in November, 1920, has now been finished. Built in Sheerness Dockyard, it has a length of 143 ft. over all, and a width of 51 ft., with a lifting capacity of about 200 tons. The dock should have ample accommodation for two of our largest modern seaplanes.

Good Work of an Avro

The Queensland and Northern Territory Aerial Services, Ltd., have in use an Avro biplane, fitted with a Sunbeam "Dyak" engine. This machine has now flown 7,400 miles in 111 hours with 285 passengers at a cost of 9 cents per mile. Good pioneer work that.

Canadian Licenses

The Canadian Air Board reports the following licenses in force on August 31, 1921: Private Air Pilots, 61; Commercial Air Pilots, 93; Air Engineers, 149; Air Navigators, 1; Civilian Aircraft, 59; Civil Government Aircraft, 30; Canadian Air Force, 59; Civil Air Harbor Licenses, 21.

Australian Air Mail

The government has asked for bids for a weekly air mail service between Sydney and Brisbane, Sydney and Adelaide, 540 and 795 miles respectively.

French Activities

The French military air service will have more than 40,000 aeroplanes next year if the Army Budget passes into law without serious alterations. The French Flying Corps would then have 286 regiments, each of 12 squadrons.

French aeroplane constructors are in a very strong position, mainly because the French Government, to help the industry, allowed the constructors to execute most of the outstanding war contracts. French constructors have on hand substantial orders from Japan and South America.

The first regular oversea airship service is now being organized by a French syndicate, to whom the French Government will make over airships and equipment. The service will be between Marseilles and Algiers, with a halting point, when required, on the Balearic Islands. The distance is 500 miles, and it is reckoned that the journey will be made comfortably in about eight or ten hours.

One of the airships to be used on this route is the Nordstern, the last to be built by the German Zeppelin works, which has been handed over to France by order of the Inter-Allied Commission, in replacement of airships which were destroyed in their sheds by German crews.—*From London Times, August* 19, 1921.

Particulars of three new metal aeroplanes which have been built at the Petit Creusot factories at Chalon-sur-Saone, are described in the Paris *Temps*. These aeroplanes—Henri Paul, B.4—are military machines designed for night raids, with a framework made entirely of metal (steel and duralumin).

They are biplanes with a lifting surface of 220 sq.m. (263 sq. yards), the wings being 30 m. (32.8 yards) from tip to tip. Their armament consists of twin machine-guns, fore and aft, with mobile guns, and their carrying capacity is 1,800 kg. (nearly 4,000 lbs.), in addition to enough petrol for a flight of five hours, which would give the machine a radius of 500 miles.

There are four motors of 350 horse-power; oil is contained in four reservoirs and petrol in four others, all isolated from the motors. The total weight of the aeroplane in flight is 9,000 kg. (2½ tons). Its speed at an altitude of 2,000 m. (6,500 ft.) is 100 miles an hour, and its minimum speed is 56 miles. The machine can rise to a height of 5,500 m. (18,000 ft.).

German Air Lines

According to a statement credited to Capt. Guest, head of the British Air Ministry, Germany now has ten commercial air lines in operation, as follows:

		Fare in Marks
(a)	Berlin to Danzig and Konisberg	975
(b)	Berlin to Bremen and Munster	650
(c)	Berlin to Bremen and Wangeroog	650
(d)	Berlin to Brunswick and Dortmund	800
(e)	Berlin to Dresden	500
(f)	Berlin to Leipzig, Nurnberg, Munich and Augsberg	1,725
(g)	Hamburg to Magdeburg, Leipzig, and Dresden	700
(h)	Munich to Constance	400
(i)	Stuttgart to Constance	450
(j)	Travemunde to Warnemunde, Sassnitz and Swinemunde	550

Some 6,000 miles are said to be flown daily.

Captain Guest also stated: "The German Government is unquestionably fostering civil aviation, which is, however, at the moment considerably handicapped by the restrictions on the construction of aircraft imposed by the Treaty of Versailles. There are in Germany two main bodies which virtually control all air traffic—the Deutsche Luftreederei and the Nord Deutsche Lloyd. The latter comprises some eight or ten companies—the most important of which are the Rumpler Albatross, Sablatnig, and Junker concerns. A large number of societies have been founded throughout the country with the object of stimulating interest in and promoting the development of aviation in all its civil aspects. The Government is indirectly represented on the 'Flug and Haven,' which is the most influential of these institutions."

Airship Base for Spain

A German commission is examining the Spanish coast from Huelva to the mouth of the Guadalquivir, with the object of establishing a large Zeppelin base for communication with South America.

The Germans, though their activities in matters aeronautical are restricted by the provisions of the Peace Treaty, have never lost their interest in aviation. Although they may not build, there is nothing to hinder them in making plans for the future.

London-Madrid Service

An irregular passenger service by air to Madrid is announced by the Lep Aerial Travel Bureau of London.

A large number of aeroplanes of various types are being delivered to Spain and advantage is being taken of the seats available to institute a passenger service.

The flight will be made in easy stages and will occupy approximately two days, but should the passengers' requirements necessitate greater speed, the flight will be made in one day.

At presnt twice-weekly departures are proposed.

New Zealand Favours Aviation

It is evident, from a recent statement made by Sir Heaton Rhodes, New Zealand Minister of Defence, that the New Zealand Air Board is justifying its existence. In outlining the work of the Air Board, Sir Heaton said that the Government had decided, after the matter had been thoroughly considered by the Air Board, to make provisions for the development of aviation along lines which would enable the Dominion to possess civil aviation for commercial and other needs, and at the same time to provide for the necessities for aerial defence in case of emergency.

The key of the system was the Air Board, which would advise the Government on all sides of the question. On the purely defence side the function of the Board would be to advise the Government as to the purchase, rent and preparation of key aerodromes; the purchase and maintenance of war aeroplanes; and the inspection by members of the defence staff of aviation schools and their equipment; the institution of refresher courses for ex-R.A.F. pilots, so that the valuable training of these men might not be lost to the country; and the allotment of defence machines to civil companies. The survey of routes would be undertaken by officers of the Aviation Branch of the Defence Department or by any competent aviator who might be deputed by the Board to undertake the work.

As defence aviation, owing to the great cost involved, could not be developed without the development of the commercial side, the Board was also entrusted with the duty of advising how this development could best be promoted. The general lines of the Board's duty in this respect was to advise as to: (1) Companies or private individuals that might be subsidised for the conveyance of mails and passengers on approved routes; (2) the allotment by way of loan or otherwise of Government machines; (3) inspection of privately-owned machines; (4) the reservation of rights of particular companies or individuals to fly for hire within prescribed areas. The Board would make recommendations as to contracts for passenger and mail services, and such contracts would be submitted to the Minister for Defence and also the Postmaster-General.

On general lines the Board would be an advisory authority with respect to legislation regarding aviation, and would also consider and recommend in what direction assistance should be given to the Meteorological Department, with a view to equipment to meet the needs of aviation.



ELEMENTARY AERONAUTICS and MODEL NOTES



Models Constructed By J. D. Bunch

SINCE 1917 Mr. J. Danner Bunch, of Vincennes, Indiana, has been an Aerial Age subscriber and a follower of the Elementary Aeronautics Page. The illustration below is a typical example of the recent work he has accomplished, and our readers may be interested in the description of its performances and some general notes on his activities as outlined in a recent letter to the Editor.

The compressed-air model of the tractor monoplane type has a wing spread of 54 inches and an overall length of 34 inches. The propeller is 14 inches in diameter; there is a clearance of 2 inches between the ground and the propeller blade. The best flight made with this model was 470 feet.

Concerning the trial flights, Mr. Bunch writes: "This model was flown from the top of a silo 60 feet high. A number of young men accompanied me to witness the flight. When we reached the silo it was found that the model was too large to be taken up through the inside chute, so it was necessary for one of the fellows to climb up and let a cord down on the outside. In this way the model was brought to the top, where with the aid of three assistants the tank was filled with air to a pressure of 130 pounds per square inch.

"The model was launched by hand with the wind. It climbed but very little and then settled down to straight flying. As it crossed over a barnyard an updraft caught it, making it zoom' steeply. This caused the machine to stall and dive, after which it flattened out again until the power gave out. It then settled into an easy glide and made a good landing in a stubble field. It rolled along the ground about 8 feet after the wheels touched. Upon examination it was discovered that in rolling on the ground the wheat stubble broke one of the flying wires.

"From the top of the silo, the buzzing of the motor could be heard for quite a distance. It could be heard quite plainly on the ground also. Two of the observers who were below the machine when it stalled said that as it zoomed they could hear the motor slow down and that when it went into the dive, the motor could be heard to 'tear out' again to full speed."

An attempt is to be made to take snapshot photographs of models from the silo roof.

A racing type rubber-driven model, recently completed, made a dozen flights, the best of which was 2750 feet, witnessed by a crowd of young men. This model was much admired and an offer of twenty dollars was received for it. The fuselage members were ⅛ inch by $\frac{3}{16}$ inch, tapered down at the ends. The wings were of the double surfaced type, the main wing measuring 36 by 7 inches and the small front wing, 17 by 5 inches. Propellers 12 inches in diameter. From these figures it will be seen that Mr. Bunch believes in large wing area; in fact he attributes a good measure of his success to the use of plenty of supporting surface.

The type of machine which affords him the most pleasure in experimenting with, is the single propellered r. o. g. type, both pushers and tractors. A lately completed r. o. g. pusher with a 9 inch propeller was an excellent flyer, making pretty landings even in a stiff breeze. This particular model was traded to an aviator for a half hour ride in his aeroplane.

The next model to be built will be an r. o. g. tractor monoplane having the following specifications:

Wing spread	40	inches
Chord	5½	inches
Length	32	inches
Propeller, (one)	12	inches
Clearance between ground and propeller tip	2	inches

This model will have a high center of gravity, large wing surface and a propeller with low pitch. It is believed that better landings can be made with a model having a slow flying speed and shallow gliding angle. The propeller is to be one of the "toothpick" types somewhat like one shown on a German model biplane published some time ago. It is expected that good photographs of the finished machine will be available for publication in the near future.

Woods Used in Aircraft Construction

(*Continued from Oct. 3 Issue*)

Hickory

The greater part of hickory lumber is from the following species: shagbark, shellbark, pignut, mockernut, bitternut, water, nutmeg and pecan.

Wood of the first four species named above has been suggested as a possible substitute for ash in longerons since it is tough and strong, though heavier than ash. It is used to some extent for landing skids.

Sugar Maple

This species is also known as hard, rock and black maple. Sugar Maple, which is in many respects similar to beech, is used in the same manner as birch and beech, for propellers, etc. It is also used for engine bearers.

Oaks

The white oaks comprise the following varieties: white, post, bur, cow, overcup, and chestnut oak. The varieties of red oaks are: red, texan, pin, scarlet, yellow (or black) and willow oak. These twelve species furnish the greater part of the oak lumber cut in the United States.

The white oaks shrink and swell with the weather less than do the red oaks. They glue well, finish well and are very strong. The first four species mentioned have long been approved as propeller woods. For propellers, quarter-sawed material is much more superior to plain-sawed, because it shrinks less in a radial direction.

The red oaks are not used to any extent for propellers, though some of the northern species may be found satisfactory. There is considerable variation in the strength properties of red oak lumber, even of one species, and moreover it is more likely to be defective than white oak.

White oak of the four approved species has also been approved for structural and bent work on wings and fuselages.

Yellow Poplar

This species is also known as tulip poplar, tulip tree, white wood, and hickory poplar. Cucumber and evergreen magnolia have about the same strength properties as yellow poplar.

This is a very important wood for aircraft construction. It has been used with satisfactory results for most of the wood parts of an aeroplane. While it is a little heavier than spruce and has not as high shock resisting qualities, it is comparatively strong, retains its shape well and is easy to work. It has been used to some extent for propellers, particularly by the French. It makes excellent cores for ply wood and has been so utilized in considerable quantities.

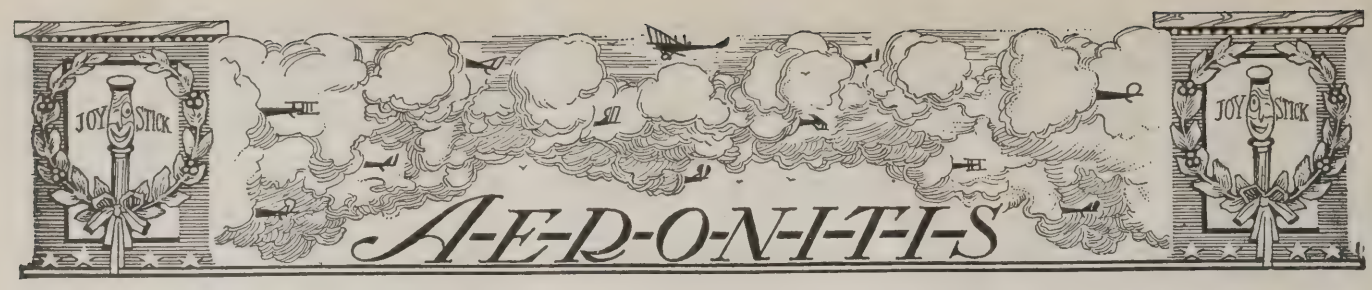
Black Walnut

Black walnut makes the best propellers of any native species. It is easy to work, finishes well. is very resistant to wear and to shocks, and retains its shape remarkably well. It is likely that walnut will be an important wood for this purpose for some time.

(*To be continued*)



J. Danner Bunch and his 54 inch compressed-air monoplane. This model has flown a distance of 470 feet



Joy Riding

1
'Twas on a Friday morning
One 13th day of May
That John McGunn, bent on some fun,
In an "Aero" sailed away.

2
He'd left the field behind him,
With skill he held the stick,
He turned, he dipped, he looped that ship
Till those who watched felt sick.

3
He skimmed on by the hour
With many a stunt and bank;
He thought of the pleasure only
And not of his gasoline tank.

4
Yes, far from the drome he floated,
His eyes on the field below,
When the joyous roar was silenced
Anr his engine refused to go.

5
His hand jerked at the throttle,
He dove that ship like the deuce,
But his efforts to get it started
Were useless without juice.

6
Now a very sensible flyer
Was this Pilot John McGunn
And he knew a bad forced landing
Would probably end his fun.

7
So a smooth looking field he spotted,
Three thousand feet below,
And pushing his joy stick forward
He let that old ship go.

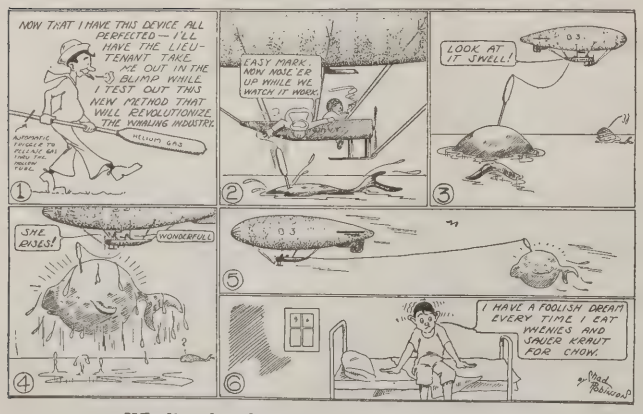
8
Not long did it take to land her,
Like a boulder dropped McGunn
Till he hit a stump with an awful bump
And tragically ended his fun.

—*"Spadite."*

Mary's Ankle

Mary bought a stylish skirt
Then grew a little taller;
So now what once was Mary's skirt
Is Mary's little collar.

—*Tennessee Tar.*



Whaling by the Air Line, by Chad Robinson in the Naval Air Current

Girls, Girls!

Headline in newspapers: "Girl carpenter drives nail like lightning." The meaning probably is she never hits twice in the same place.—*Buffalo Express.*

A Sporting Judge

"Thirty days in the workhouse. That ought to cure you of speeding."

"It certainly will, your honor. Would you like to use my car while I'm in durance vile?"

"No, thanks, I've seen you riding in that old bus of yours. It couldn't do over 18 miles an hour.

—*Birmingham Age-Herald.*

Confirmed Economists

"Yes, they are a very economical couple. They eloped to save themselves the cost of a wedding."

"Can't say that they look very happy."

"They're not, but they are living together to save the cost of a divorce." —*Foreign Service Magazine.*

Mr. Peck: "I want to take up boxing. My wife ——— ."

Instructor: "But you can't fight your wife."

Mr. Peck: "I know it. I'm not even going to try. What I want is to be able to stand punishment.—*Amer. Legion Weekly.*

That's Different

Willis: "Our company was getting 1,000 barrels a day when suddenly, on December 1, our production was stopped."

Gillis: "That's funny. I never heard of an oil well acting like that before."

Willis: "Who's talking about oil wells? This was a brewery."—*Judge.*

Never Saw a Campus

"How do you know that Perkins didn't go to college?"

"Why, he said he knew Babe Ruth when she was a chorus girl."—*Fort Mason Marking Pot.*

He Must Have Been a Man

Edith Wharton, the writer, told this war story: "The American wounded were being brought in from the second Marne battle," he said, "and a fussy American woman in a Khaki uniform and Sam Browne belt knelt over a stretcher and said, 'Is this case an officer or only a man?' The brawny corporal who stood beside the stretcher gave her a grim laugh and said: 'Well, lady, he ain't no officer, but he's been hit twice in the innards, both legs busted, he's got two bullets in both arms, and we dropt him three times without his lettin' out a squeak, so I guess ye can call him a man.' "—*Seattle Argus.*

So To Speak

One afternoon a stranger debarked from a train at a hustling town in the West and headed up the street. Finally he met a party that looked like a native.

"Pardon me," said the stranger, halting the likely looking party. "Are you a resident of this town?"

"Yes, sir," was the ready rejoinder of the other. "Been here something like fifty years. What can I do for you?"

"I am looking for a criminal lawyer," remarked the stranger. "Have you one here?"

"Well," reflectively answered the native, "we think we have, but we can't prove it on him."—*Chicago Herald.*

Nothing to Worry About

Passenger—"Say, does this car always make this noise?"
Driver—"No, only when it's running."—*Tennessee Mugwump.*

The Beast!

When they first met he said, "A bear."
He'd dog her footsteps anywhere.
She monkeyed with him for a year,
Although she said he was a deer.
A little horseplay hitched the two,
Now he's the goat. It's nothing gnu.

—*American Legion Weekly.*

COX KLEMIN AIRCRAFT CORP.

Consulting, Designing and Constructing Engineers

COLLEGE POINT, L. I.

Telephones Flushing 3682-J
Flushing 1800

FOR IMMEDIATE DELIVERY. CAN BE INSPECTED IN OUR SHOPS

STANDARD-MERCEDES

Brand-new, three place Standard with New Mercedes motor. Motor is rated at 160 h.p. and develops close to 200 h.p. Reports of pilot show perfect balance, great speed and climb. Completely equipped with instruments, and finished in every detail.

Price F. O. B. Factory..... **$3500.00**

D.H.-6 BENZ

New D.H.-6 with new Benz. The Benz six cylinder motor is rated at 120 h.p. and delivers 150 h.p. The combination makes a real two or three seater, which is in a class by itself as regards performance, general flying qualities and price.

Price F. O. B. Factory..... **$2250.00**

MOTORS

Mercedes, Benz, and Isotta-Fraschini's at reasonable prices.

AIRCRAFT MATERIALS and accessories.

Write for prices and specifications. ALL inquiries promptly dealt with. Write in and state your requirements.

Smith Life Pack In Action



Actual photograph of Lieut. Hamilton being pulled off plane at Rantoul, Illinois, in recent tests with parachute just opening, showing the perfect operation of life pack

The Floyd Smith Life Pack

Used by the U. S. Army
and Air Mail Service

The Parachute That Has

NEVER FAILED

LIEUT. HAMILTON AND SERGT. SCHROEDER used this life pack in their record-breaking jump of 23,700 feet at Rantoul, Illinois.

PILOT C. C. (MIKE) EVERSOLE used this life pack in escaping from his wrecked mail plane at Mendota, Minnesota.

MAJOR R. W. SCHROEDER, A. S. A., chief test pilot U. S. Air Service, wore this parachute in his World Altitude Record flight at McCook's Field.

You Cannot Afford To Be Without One

Information and Price Furnished on Application

FLOYD SMITH AERIAL EQUIPMENT CO.

367 W. ADAMS STREET, CHICAGO, ILL.

Any infringement will be prosecuted.

WING COVERING

Doping, Pigmenting, Enameling, Varnishing accurately, quickly and economically done

LINEN, LINEN TAPE, LINEN COVERS, DOPE

Grade A Linen—90c per yard
Grade A Cotton—50c per yard
Scalloped Cotton Tape—6c per yard

AVIATION MOTORS

Overhauled and Repaired by French Engineers
Rotary Engines a Specialty

G. VOISIN, Expert

20 Years of Practical Experience

Tel. 139 W. Hasb. Hgts. 236 Franklin Ave., Hasbrouck Heights, N. J.
Factory: 70-72 Rome St., Newark, N. J. Tel. Market 9170.

SPECIAL OFFER (to Sept. 15th, 1921)

Limited Quantity of

New Wheels with Casing and Tube

$12.00 complete. F.O.B. Buffalo

CANUCK
JN and OX5

SPARES and SUPPLIES

ONE USED "CANUCK" $1200.00 U.S. Funds
F.O.B. Leaside

Write us Direct for Quotations

ERICSON AIRCRAFT LTD.
120 King Street E. Toronto, Canada

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet.

PHILADELPHIA AERO-SERVICE CORPORATION
636 Real Estate Trust Bldg. Philadelphia

CANUCK

AND

OX5 ENGINE SPARE PARTS

IMMEDIATE DELIVERY

C. A. L. PROPS $15 PARAGON PROPS $30

ROME-TURNEY RADIATORS $20

Also Complete Assortment of Standard Utility Parts

Get Our Prices Before Ordering

AIRCRAFT MATERIALS & EQUIPT. CORP.
1409 SEDGWICK AVE. NEW YORK CITY

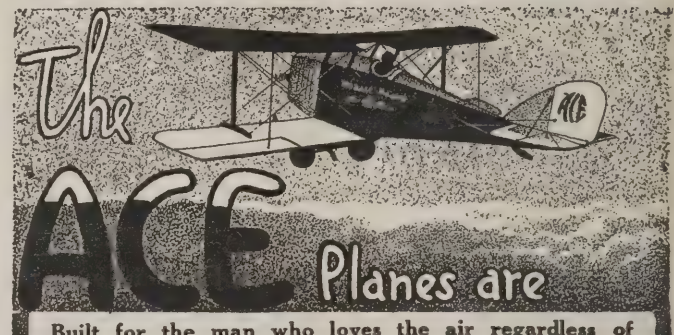
Baker's A-A Castor Oil



Specially Refined
for the Lubrication of
AERONAUTICAL MOTORS

BAKER CASTOR OIL COMPANY
Founded 1857
The Oldest and Largest Manufacturers of Castor Oil in the United States
120 BROADWAY NEW YORK

The ACE Planes are



Built for the man who loves the air regardless of the business that calls him.

AVIATION SCHOOLS!
Solo students on the ACE

HORACE KEANE
Aero Planes
Sales Office: 505 Fifth Ave., N. Y. Factory: North Beach, Long Island

The Spark Plug That Cleans Itself

B-G

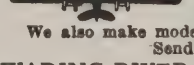
Contractors to the U. S. Army Air Service and the U. S. Navy

THE B. G. CORPORATION

33 Gold Street New York City, U. S. A.

Students of Aviation, Model Builders and Experimenters

The Wading River Model Airplane & Supply Co., as the oldest establishment of this kind in the U. S., is able to supply you with the best material at the most reasonable prices.



Scale Drawings and Blueprints of some of the latest types always on hand.

We also make models to your own plans at reasonable prices.
Send $.05 for Illustrated Catalog.

WADING RIVER MFG. CO., 672 Broadway, Brooklyn, N. Y.

Say—Men—How Do These Prices Sound?

Canuck Wings	Uppers	$120.00
	Lowers	115.00
Ailerons		15.00
Rudders or Elevators		12.00
Axles, Tires, Struts, New Pistons, 4 New Valves, Each		5.00
Used A1 Cylinders (nearly new)		10.00
Radiators (used) but A1		17.50

Tachometers, Altimeters or Compasses.....15.00
New D-5000 Mahogany Cop. Tipt. Props.....50.00
Special Low Prices on "D" Parts Are Even Slightly Lower Than Above
Re-built OX-5 Motors...$300.00
New OXX-2 Left Hand.. 650.00
Used and New Planes (Ready to fly) $1250 to 2500.00

DE LUXE AIR SERVICE, Inc., Asbury Park, N. J.
(Wings now in crates one block from R. R. Station)
50% must accompany all orders.

AVIATION
FLYING AND GROUND SCHOOL

COURSES TAKEN SEPARATELY OR COMBINED

We have the very best of flying instructors. Our ground instructors will teach you motors from A-Z and show you how to build an airplane from the ground up.

We specialize on MOTOR MECHANICS and RIGGERS and can turn you out qualified to handle such position paying from $200 to $300 monthly.

Write for descriptive literature.

THE LOWELL AIRCRAFT CO., Inc.
Oberlin, Ohio

Imported Commercial Aerial Cameras

Latest model brand new 7" x 9" GAUMONT CAMERA, 20" f/6.3 Krauss Lens, 12 plate automatic magazine suitable for mapping and obliques.....$500.00
Extra 12 plate automatic magazines..... 40.00
5" x 7" GERMAN ICA CAMERA, 12" f/4.5 Voigtlander Heliar Lens including four all aluminum plate magazines 400.00

FAIRCHILD AERIAL CAMERA CORPORATION
136 West 52nd Street New York City

Used OX5 motors overhauled guaranteed 1400 r.p.m., $175.00.
Flottorps toothpick copper tipped, $45.00.
New OX5 cylinders, $24.00.
New radiators, honeycomb, $25.00.
C. A. L. props OX5, $18.00.
New OX5 pistons, $4.50.
Tons of other parts as cheap, quality and service count. 14 years actual experience.

PARKER AIRCRAFT CO.
Perry, Iowa

PHENIX FIREPROOF DOPE

Prices Have Been Reduced

The FIRE HAZARD will be reduced by using Phenix Fireproof Dopes and Paint

Get our prices of regular Acetate and Nitrate Dopes mixed to Navy Specifications

PHENIX AIRCRAFT PRODUCTS CO. Williamsville, N. Y.

CURTISS SHIPS FOR SALE

$500.00 AND UP

CURTISS EASTERN AIRPLANE CORP.
130 S. 15th STREET PHILADELPHIA, PA.

Advertising in this department 10c a word $2.50 minimum

Classified Advertising

Forms close for this department on Monday preceding date of issue

PATENTS Ex-Pilot U. S. Air Service
ALLEN E. PECK
Patent Attorney
Pacific Bldg., Washington, D. C.

ANZANI 10 cyl. 100 H.P. motor with propeller, good condition, $175. Sturtevant 8 cyl. V-140 H.P. motor with new oak propeller, good condition, $200. Heber H. Hunt Aeronautical Engineer, P. O. Box 1643, Washington, D. C.

FOR SALE—Enormous stock OX-5 Motor parts. Best prices. Try us for quick service. The Lowell Aircraft Co., Oberlin, Ohio.

WILL SACRIFICE Standard equipped with new 210 H.P. Curtiss motor never been run. $2000 cash. Also complete line Jennie parts and two OX5 motors. H. V. Farris, London, Ky.

FORMER R.A.F. and U.S. PILOT, 32 types, flying all summer, will go anywhere, small salary. Any kind of flying. Address Box 626, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

WANTED—We buy and rebuild airplane crashes. Try us for prompt, accurate and satisfactory work. The Lowell Aircraft Co., Oberlin, Ohio.

FOR SALE—One Curtiss J.N. with OX5 motor, completely knocked down and in need of new fabric and minor repairs. This is not a crash. Price $500. The Lawrence Sperry Aircraft Co., Inc., Farmingdale, L. I., N. Y. Phone Farmingdale 133.

FULL SET WINGS, ailerons, struts and cables, tail surfaces and rudder, center section and struts, radiator, landing gear for Oriole nearly new. Cheap. Muskogee Airplane Co., Muskogee, Okla.

CANUCK AEROPLANE COVERING REMOVED, plane and motor needing minor repairs, sacrifice $500.00. Nearly new OX5 with propeller and radiator, sacrifice $350.00. New Standards with new motors sacrificed. Gulf States Aircraft Co., Shreveport, La.

SEVERAL AEROPLANE CAMERAS for sale with Bausch & Lomb 8½-inch (I. C. Tessa F4 5 in aerial mount), including magazine holders carrying a total of 36 plates. Cameras brand new, same as used by U. S. Air Service during war. Price F. O. B. New York $350.00. Address Box 610, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—One Aeromarine 39B seaplane complete, in splendid condition. Used less than ten hours. Ready to fly away. Best offer by Oct. 1st takes it. Also, one JN4D just overhauled and in exceptionally fine condition. Good as new. Best offer in reason takes it. Ready to fly away. Best buys of the season. Harry E. Cumerford, Peoria, Ill.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

FOR SALE—Canadian Curtiss with new OX5 motor this summer. Now in use and ready to go anywhere. Extras include OX5 motor, landing gear, prop, compass and engine parts. A bargain at $1500. Henry B. Wisner, Middletown, New York.

K-6 ORIOLE, OX5 STANDARD AND JN4D, all in first class condition, for sale at sacrifice. 613 North Marsalis Ave., Dallas, Tex.

C. A. L. PROPELLERS $20, very efficient; others at $32; copper tipped $42; Canuck and OX5 parts at cut rates. No catalog—specify your wants. Chas. H. Paterson, 6504 So. State St., Chicago, Ill.

YOUNG MAN, graduate of the American School of Aviation, desires position with aeroplane company. Anything considered. E. S. Anderson, Station A, Chattanooga, Tenn.

FOR SALE—Huntington Monoplane complete with Kemp 18-20 H.P. aircooled motor. But right wing needs recovering or patching. Price $100 down and $100 C.O.D. J. Offerbaugh, 1032 W. 14th Ave., Denver, Colo.

IF YOU LIVE NEAR NEW YORK and want to build small sport plane write to Box 625, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

BRAND NEW $7000.00 two and four passenger aeroplanes for sale at half price for quick delivery. Ready to fly. Cash only. Address Box 623, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

CANUCK, AEROMARINE and NEW BRISTOL without motor, monoplane fuselage cheap. Aeromarine pontoons. OX5 motor. 28 H.P. motor with propeller. Sheepshead Bay Aero Company, Brooklyn, N. Y.

FOR SALE—New S.V.A. two passenger aeroplane. Any reasonable cash offer accepted. Alexander & Keenan, 55 William St., New York City. Telephone John 565.

STANDARD commercial planes, Hispano Suiza motor, double ailerons, $2500 and up. Canuck, ready to fly, at your figure. Walters Airplane Co., Box 222, Walters, Okla.

FOR SALE VERY CHEAP — Flying suit, water-proof and fur lined, in excellent condition except that the fur is somewhat worn. Apply Frank H. Brickner, c/o The Menter Co., 469 Seventh Ave., City.

CANUCK — Looks fine, flies better, new linen, revarnished, repainted; motor overhauled with $200 new parts. Will go for $1500 with many spares. Mac Short, 1614 Fairchild, Manhattan, Kans.

AS EXECUTIVE, PILOT, SALES MANAGER, an ex-Royal Flying Corps flying officer desires to connect with reliable aircraft manufacturer, distributor or flying school. Over 2500 hours flying. Instructor (Gosport System) has special system for selling. Go anywhere. Recommended by insurance companies. Address Box 627, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

BRAND NEW $7,000.00 two and four passenger aeroplanes for sale at half price for quick delivery. Ready to fly. Cash only. Address Box 623 c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—American Curtiss, three passenger, Hispano Suiza motor, in excellent condition. Set up and ready to fly. Linen new recently. Fuselage completely covered with aluminum, new Flottorp propeller. Ship never been crashed. A bargain at $1250.00 for immediate sale. H. J. Wheeler, 3823 Highland, Kansas City, Mo.

MAGNETOS, 2 Berling 8 cylinders, $25.00 each. 3 Berkshire 8 cylinders, $22.50 each. 2 Bosch 6 cylinders, $25.00 each or $40.00 pair. 1 Bosch booster magneto, $17.50. M. A. Northrop, Minneapolis Athletic Club, Minneapolis, Minn.

FOR SALE—Like new, three place Standard J.1, OX5 motor. New linen throughout. Plane ready for test flight, $2100. Want quick sale. T. J. Rice, Oberlin, Ohio.



LEARN TO FLY

in Chicago with

THE RALPH C. DIGGINS CO.

YOU start flying the day you arrive. Competent Instructors. Newest Types of Planes. Gosport System of Instruction. Thorough Ground Course, including instruction in motors, plane-assembly, wireless, navigation, cross-country flying, field management. Living quarters right here on the field.

PILOTS Receive $5,000 Per Year and Up

ENROLL NOW!

Write for literature and enrollment offer.

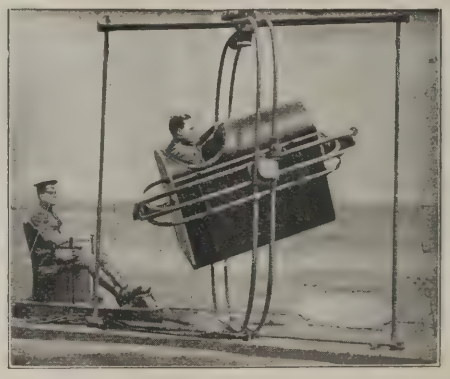
THE RALPH C. DIGGINS CO.

Dept. 203 **140 N. Dearborn Street**

CHICAGO, ILL.

These Models of the

Ruggles Orientator



were manufactured by the U. S. Government under the supervision of the inventor. Duplicates—with improvements—will now be manufactured for civilian aviation schools, also 2 passenger models for amusement park purposes.

Foreign and Domestic Patents Allowed and Pending

Ruggles Orientator Corporation

168 W. 73d Street, New York City

(*Continued from page* 111)

Detachment		*Approx. Strength*	*From*	*To*
"	.....	37	Camp Bragg....	Langley Field
"	(See Note 8).....	52	Camp Knox.....	Aberdeen
"	(See Note 9).....	10	Chanute Fd.....	Ft. Riley
"	(See Note 10).....	100	Chanute Fd.....	Mitchel Fd.
"	(See Note 11).....	95	Chanute Fd.....	Carl'm Fd.
"	(See Note 12).....	180	Fairfield, O.....	Scott Fd.
"	(See Note 13).....	64	Fairfield, O.....	Mitchel Fd.
"	(See Note 14).....	5	McCook Fd.....	Post Fd.
"	(See Note 15).....	3	McCook Fd.....	Kelly Field
"	(See Note 16).....	4	McCook Fd.....	Mitchel Fd.
"	(See Note 17).....	2	Middleton, Pa.,..	Mitchel Fd.
"	(See Note 18).....	2	Middleton, Pa.....	Langley Fd.
"	.....	7	Love Field.....	Kelly Field

Note 1—The designations carried in this column are the new designations ordered above.

Note 2—Temporary Station Eugene, Oregon.

Note 3—The Second Group, (Bombardment) to be moved consists of:
Headquarters, 2nd Group (Bombardment)
11th Squadron (Bombardment)
20th Squadron (Bombardment)
Air Park No. 5.
Photo Section No. 1.

The 49th and 96th Squadrons (Bombardment) belong to this Group and are now stationed temporarily at Langley Field.

Note 4—To El Paso, Texas, for temporary station.

Note 5—This detachment should be sent in the following grades:
8 Sergeants, 8 Corporals, 2 Privates 1st cl., 2 Privates.

Note 6—This detachment should be sent in the following grades:
6 Sergeants, 9 Corporals, 13 Privates, 1st cl., 22 Privates.
All personnel lighter-than-air.

Note 7—This detachment should comprise all remaining Air Service Personnel at Camp Benning after the detachment of 50 is sent to Lee Hall.

Note 8—This detachment should be sent in the following grades, all personnel lighter-than-air:
4 Sergeants, 4 Corporals, 5 Privates, 1st cl., 39 Privates.

Note 9—This detachment should be sent in the following grades:
1 Master Sergeant, 1 Staff Sergeant, 1 Sergeant, 1 Corporal, 2 Privates, 1st cl., 4 Privates.

Note 10—This detachment should be sent in the following grades:
5 Staff Sergeants, 95 Privates.

Note 11—This detachment should be sent in the following grades:
2 Master Sergeants, 1 Technical Sergeant, 17 Staff Sergeants, 57 Privates.

The detachments sent from Chanute Field should not reduce the total strength of the Mechanics' School, Observation Squadron (reduced strength) and the Photo Section below 210.

Note 12—This detachment should be sent in the following grades:
5 Sergeants, 8 Corporals, 49 Privates, 1st cl., 118 Privates.

Note 13—This detachment should be sent in the following grades:
9 Master Sergeants, 32 Staff Sergeants, 16 Sergeants, 7 Privates, 1st cl.

Note 14—This detachment should be sent in the following grades:
5 Master Sergeants.

Note 15—This detachment should be sent in the following grades:
3 Master Sergeants.

Note 16—This detachment should be sent in the following grades:
4 Staff Sergeants.

Note 17—This detachment should be sent in the following grades:
1 Master Sergeant, 1 Staff Sergeant.

Note 18—This detachment should be sent in the following grades:
1 Staff Sergeant, 1 Corporal.

Note 24—The Gunnery Detachment for Carlstrom Field is to consist of 75 enlisted men and table of organization is being submitted for the same.

7. That Circular No. 208, War Department, 1921, govern as to equipment, property and funds.

UNIVERSITY OF ILLINOIS
OCT 7 1921

AERIAL AGE WEEKLY

VOL. 14, No. 6 OCTOBER 17, 1921 10 CENTS A COPY



University of Pennsylvania, Philadelphia. Photographed by the Aero Service Corp., Philadelphia

The Future of Aviation

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
ubscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

$20,000.00 in PRIZES!

$10,000.00 in CASH — $10,000.00 in TROPHIES

CONTACT! Off for Kansas City! Get into the biggest Aerial event in history. Bring on your ships. Take home the bacon—$20,000 worth of prizes in real coin of the realm and handsome trophies. A gigantic Flying Meet for every type of plane. Make your plans NOW to come to the—

OFFICIAL
American Legion
FLYING MEET

(In conjunction with the Third Annual American Legion Convention)

KANSAS CITY, MO.—OCT. 31—NOV. 1 & 2

A mammoth Spectacle of the Air for three days and nights. Meet your old buddies. Meet America's foremost aces and scores of other notables. See the greatest collection of ships ever assembled. And take part in your favorite events. A meet the world will talk about!

FREE Gas! — FREE Oil! — FREE Service!

At the Field for All Contestants!

A Few of the Events:

THE LEGION DERBY

Open to any make of plane, horsepower, or wing spread. Machines to start at scratch, race over a triangular course of 5 miles, 30 laps or 150 miles in all. Prize one leg on a cup costing $2500.00. This must be won twice to become the permanent property of the winner. Another beautiful cup, valued at $1200.00, will be awarded the winner of first place, as his permanent property. These prizes will be presented by the President of the United States on the floor of the Convention Hall. In addition, cash prizes of $3000.00 are offered for first, $2000.00 for second, and $1000.00 for third place.

STUNTING CONTEST

Three best planes will be picked for finals to be held on the following day. Absolutely no stunting to be done under an altitude of 1000 feet. $600.00 Silver Cup for first place.

LEGION JUNIOR DERBY

The Legion Junior Derby. Open to all ships of less than 100 miles per hour air speed. The race will be five times around a triangular course of 15 miles; 75 miles in all. Prizes—A large silver cup valued at $1250.00, to be awarded by the President of the United States in addition to cash prizes of $1000.00 for first, $500.00 for second, $200.00 for third, and $100.00 for fourth place.

RELAY RACE

Entries open only to JN4D's and Canucks, or ships of the same type. Four planes to a team. Teams will race from a standing start once around a 15-mile triangular course, 5 miles between corners. Prizes to the winning team, $250.00 cash to each pilot; second place $125.00 to each pilot, total $1500.00.

Looping Contests, Altitude Tests, Night Flights, Parachute Drops and scores of other events that will bring valuable Cash and Cup prizes to the winners.

OPEN TO ALL! Our official booklet containing full information on each event, cuts of trophies to be awarded in addition to cash prizes, rules of the course and field, is now ready for mailing. This booklet also contains official entry blanks. Send for yours at once. Don't miss this greatest of all Flying Meets. Write today.

Flying Club of Kansas City

Room 126 Hotel Baltimore **Kansas City, Missouri**

October 17, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 6

TABLE OF CONTENTS

The Future of Aviation 123
The News of the Week..... 124
United States Post Office Department Air Mail Service..... 125
The Aircraft Trade Review 126
MacReady's Altitude Flight 127
Large German Airship Stations.... 128
Admiral Fullam on the Alabama Tests 130
The Rumpler 1000 H.P. Engine... 131
Information for Pilots Giving the Practical Characteristics of the Land Along Various Routes..... 132
What Airships Can Do..... 134
Naval and Military Aeronautics... 135
Foreign News 136
Elementary Aeronautics and Model Notes 137
Aeronitis 138

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

AIR PLANES WICHITA KANSAS

The Laird Swallow
"America's First Commercial Airplane"

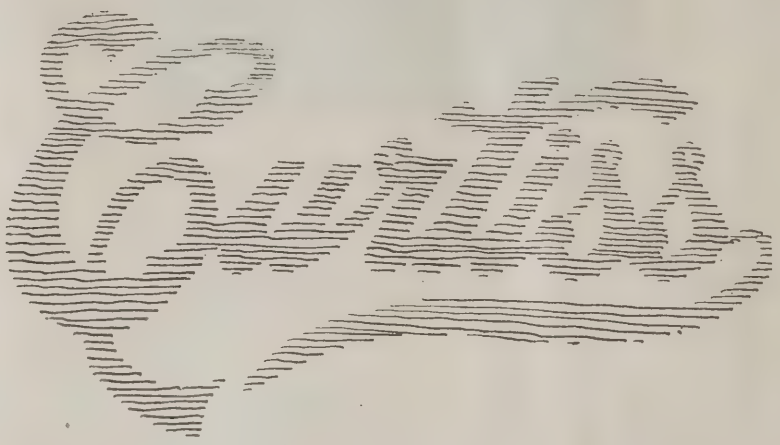
NOW $4,500 F. O. B. WICHITA, KAN.

INCREASED production enables us to announce this reduction, effective immediately. At this price the Laird Swallow will be the most wonderful buy in America today. Brand new in every detail—built in our own factory, powered with the OX5 motor, carrying three passengers with full load of fuel and baggage—magnificent in performance—remarkably low upkeep and operation costs.

Our new sales plan will be most interesting to every person interested in aviation. Write for details and booklet.

E. M. LAIRD COMPANY
Manufacturers
WICHITA, KANSAS
General Sales Offices
2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.,
2216 So. Michigan Ave., Chicago, Ill.
Please send me details of your new sales plan and copy of booklet.
Name .....
Address .....
.....
AA



A Further Reduction

APPROXIMATING 25%

in the price lists of parts
for

Orioles
O X Standards

Jennies
C 6 Standards

is announced

EFFECTIVE SEPTEMBER FIRST

Write for revised price lists.
Motor price lists are not affected in this reduction.

CURTISS
AEROPLANE AND MOTOR CORPORATION
GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., October 17, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, OCTOBER 17, 1921 NO. 6

THE FUTURE OF AVIATION

IN an interesting article from *La Presse Interallies,* published in the New York *Times,* Henri Farman, the noted French aeronautic pioneer, presents some interesting thoughts on the future of aviation. Following are a few excerpts:

The question of landing grounds is one of primordial importance, and is vital in regard to the future development of aviation. The existing landing grounds are not only insufficient in number, but are situated too far from cities and towns for the use of aircraft to become generally practicable. I am inclined to think that among the many causes that slackened the progress of aviation the principal two are to be found in the continued use of motors primarily designed for war purposes and the shortage of landing grounds on the various aeroplane routes.

Another factor which must also be considered is the lack of interest displayed by the masses of the people in aerial locomotion. The public, I am convinced, will have to be educated in this subject little by little. Crowds have a great tendency, especially in Europe, to be influenced by tradition, and some considerable time must be allowed to enable them to understand and realize the utility of a new invention.

To insure the security and the comfort of aerial passengers, to prove to the public that when they mount into the cabin of an aeroplane they are not performing a heroic act but merely selecting, on the contrary, perhaps, the means of transport that is best calculated to preserve their lives; this is another direction toward which should be directed the efforts of those who know what the coming developments of aviation will probably be, and who foresee an advance in this form of locomotion that will astonish the world.

The purchase price and the running cost of an aeroplane are undoubtedly below those of an automobile. Moreover, if the use of aircraft has up to the present been reserved especially for long-distance traveling, I believe that sooner or later this view will be changed and that the aeroplane will obtain equal popularity for short distances. Later on, in short, I believe we shall take an aeroplane in exactly the same manner as we now jump into a motor-bus or a taxicab.

In the years that are coming aircraft will be called upon to play a pre-eminent rôle not only in the domain of peace relations and commercial life, but also, unhappily, in the sphere of military activity.

The war of the future, I believe, will assume an exclusively aerial and technical form. The aeroplane will no longer be, as it was during the recent frightful struggle, "the eye of the army," but really a decisive factor of victory.

Aeroplanes will be grouped in squadrons of 100 or more machines, and our children will thus see being fought out before their eyes homeric struggles between two formations of this strength.

The most powerful German aeroplanes during the period of the war were able to transport only half a ton of explosives. A Goliath type of aeroplane carries a load of over three tons. A Goliath, moreover, can transport, in addition to its crew, twenty fully armed and equipped soldiers, each accompanied by a machine gun.

It is easy to realize what a really formidable force would be represented by a squadron of 100 aeroplanes carrying cargoes of this kind, for it must not be overlooked that the part that will be played by aeroplanes in the wars of the future will not be confined merely to conflicts against the aerial forces of the enemy.

In addition to the methodical and almost instantaneous bombardment of the towns and cities in the rear of its fighting front—and unhappily the distance from, say, Berlin to Paris is not very great!—aeroplane squadrons will also play a decisive part in the combat of operations on the ground.

Suppose, for instance, that a squadron of Goliaths, each carrying twenty soldiers, succeeds in crossing the enemy's lines without encountering any aerial force belonging to the other side, or that it encounters and fights and destroys an enemy force and is still able to continue on its mission. What would it be able to do?

The victorious squadron might be able to land behind the enemy's lines. In less than a couple of hours a substantial military force would have been massed in the enemy's rear and all his entrenchments and military works would be turned. The troops of the country which had lost the supremacy of the air—the impregnability of the "air front"—would suddenly find themselves compelled to fight on two fronts at the same time, or, rather, to surrender to the enemy.

Down to the present, unfortunately, the German Government and people appear to have realized much more completely than the French Government and people the future military importance of aviation.

It may be asserted without fear of contradiction that the nation which succeeds in acquiring the mastery of the air will secure for itself at the same time pre-eminence in the world. And this fact, I am convinced, is also indisputable; that if a fresh war occurs, its issue will be decided beyond all doubt by aerial fighting.



The News of the Week



Mineola Aviation Day

The Contest Committee of the Aero Club of America announces that an Aviation Day will take place on the Curtiss Field, at Mineola on Sunday, Oct. 16, through the courtesy and co-operation of the Curtiss Aeroplane & Motor Co. in loaning the field.

Following is the program of the Aviation Day:

1. Aero show which will last all day. Each exhibitor will have his exhibit on the field in front of a hangar, all of which are numbered and on which he may display a sign. The location of each exhibit will be found in the program, which it is hoped can be given gratis to all paying admission to the field. Should exhibitors wish to insert page advertisements, they may do so for the cost of the printing and paper. By having the exhibits on the field instead of in the buildings the public may examine them at their leisure without being afraid of missing any of the flying.

2. Demonstration flights of aeroplanes. Each exhibitor is requested to make one or more exhibition flights to show the performance of his machine, engine, etc. The nature and duration of each flight should be sent in writing to the Contest Committee of the Aero Club, who will assign a time for each flight and publish it in the program together with the name of machine, engine, pilot, and purpose of the flight. In this way anyone interested in a machine will know at what time it will fly, and the public will know at all times what machines are in the air.

3. Trophy for best completed demonstration of aerial transportation from or to New York by aeroplanes or seaplanes within 8 hrs., starting at 9 a. m. and finishing at 5 p. m. The New York terminus must be the Curtiss Field for aeroplanes, and Port Washington for seaplanes. Contestants shall notify the Contest Committee of their intention to enter, and give name of aeroplane, motor and pilot. The exact nature of each contestant's contemplated trip should be sent in a sealed envelope, which will not be opened until after the entries have closed at noon Oct. 10. This will insure entrants against having their ideas stolen or copied, but will give time to have the proposed trips printed in the program and newspapers. Each contestant should explain fully the advantages of his proposed trip over the other means of transportation, measuring it in time, dollars and cents, or any other way, to assist the judges in awarding the trophy. The judges shall be the Aviation Editors of the New York papers, and the trophy shall be awarded on points as follows: Each editor shall publish in his paper his choice for the first five places, and in each published list the Contest Committee will award 5 points for first place, 4 points for second place, 3 points for third place, 2 points for fourth place, and 1 point for fifth place. The contestant receiving the greatest number of points shall be awarded the trophy. However, no contestant shall be eligible for the trophy unless the proposed flight is actually completed.

Air Mail Planes at Kansas City

As a special mark of appreciation to Marshall Foch, who will be the guest, with other notables, of the American Legion at the third annual convention in Kansas City, Mo., on October 31, November 1st and 2nd, Postmaster-General Hays has arranged to have an Air Mail squadron of six aeroplanes fly to Kansas City on one of the days of the convention. The ships of this squadron will be regular mail planes mobilized at Omaha from stations on the transcontinental route—from New York to San Francisco—and will fly in formation from Omaha to Kansas City. Air Mail service has been authorized between Kansas City and Omaha during the American Legion Convention.

French Motor Prize

Paris.—The French Committee for Aeronautic Propaganda has decided to create a prize of 1,000,000 francs for the commercial aviation motor which best satisfies tests in a competition to be arranged, in point of durability, regularity, simplicity, dismounting and upkeep.

The competition, according to the committee's announcement, will be international, under the regulations of the International Aeronautic Federation, but a foreign builder taking part must engage to construct his motor in France, if he wins. Motors should be ready by June 1, 1923, and the Aero Club of France has been intrusted with carrying out the competition.

No Blame Fixed for ZR-2 Disaster

London.—At the adjourned inquest upon the victims of the R-38 disaster at Hull, the jury on October 4 returned a verdict of accidental death and found no evidence regarding the actual cause of the dirigible's destruction.

This decision, unsatisfactory so far as the second part is concerned, followed a most remarkable summing up speech by Deputy Coroner T. C. Jackson, who gave opinions expressing satisfaction with the ship's construction and condition which were not supported by any evidence heard during the inquest. He gave no authority for the several such statements made. The only source from which he could have got them is the unpublished report of the Air Ministry investigation.

If the full evidence of that inquiry is not published, in view of the failure of the Coroner's Jury to disclose the cause of the accident, the public may never know whether there is any truth in the repeated unofficial reports that the authorities knew the ship was not airworthy. Dr. Jackson gave the jury this assurance, however:

"Tests made during the progress of the construction were satisfactory and any necessary modifications were carried out." Further on, after referring in considerable detail to the faults discovered and repairs and changes made during construction and after the first flying trials, he again assured the jury:

"Everybody was quite satisfied that nothing further could be done and the vessel represented the last word in human foresight, skill and knowledge in airship construction of this kind."

Loening Establishes Another Record

Traveling at an altitude of 10,000 feet a Loening flying yacht on October 7, established what was said to be a new world seaplane speed record when it flew from Aberdeen, Md., to Port Washington, L. I., an airway distance of 188 miles, in 80 minutes, more than two miles a minute. The eigthy-eight miles airway distance from Philadelphia to the Battery was covered in 32 minutes.

The feat was all the more remarkable because of the fact that Clifford Webster, the pilot, was handicapped by strong wind currents which made it necessary for him to mount to 10,000 feet, where he found conditions favorable for fast flying.

Those who made the trip were Grover Loening, the designer and builder; H. C. Richardson, who commanded one of the N-C flying boats in the transatlantic race; a mechanician and Pilot Webster. A fourth passenger was landed at Philadelphia, but as the plane did not remain there the flight was considered virtually a non-stop one. The party flew from Port Washington to Aberdeen, but strong head winds made it impossible for the plane to fly the maximum speed with which it is credited.

"We left Aberdeen, where I had been called on business, at 3:10 in the afternoon," Mr. Loening said. "We decided not to follow the water route generally used by seaplanes, but to take the direct land route back to Port Washington. We had made many tests with the flying boat and believed that it could negotiate the distance without any trouble.

"For a short distance we flew at a height of 2,000 feet, but the pilot experienced difficulty with a strong wind current, which made it difficult to get the desired speed out of the plane. He decided to climb to 10,000 feet to find if the air was better there. We mounted the 8,000 feet at the rate of 1,000 feet a minute.

"Here we found conditions ideal. There was a good tail wind which enabled us to go forward with increased speed. We traveled the distance between Aberdeen and Philadelphia in a half hour. Thirty-two minutes after we left Philadelphia we were over the Battery. It is worth noting that had anything gone wrong with our engine we could have glided from the height we maintained to a waterway landing spot with perfect safety.

"We could have clipped a few minutes from our time, if it were not for the necessity of coming down from 10,000 feet. I feel certain that the flying boat can better that time and hang up a new record which will remain for some time."

Pilot Webster was enthusiastic over the performance of the plane, which has been undergoing a series of tests since it was developed in the early part of the Summer. He said that the 400-horsepower Liberty motor hand functioned perfectly.

King of Spain Joins Air Commuters

Paris.—King Alfonso of Spain has joined the ranks of royal air commuters. An air taxi designed for his personal use, has been completed by a French firm. The machine will make 130 miles an hour and bears the royal coat of arms. Jaille, a well known French pilot, will act as chauffeur.

Added Kansas City Event

Another event has been added to the long list of contests to be held at Kansas City. This will be a long distance endurance race to Kansas City from a minimum distance of 600 miles. There will be $1,000 cash prize for the winner, and $500 for the contestant with the second best record.

Wind Aloft

Wind Aloft is the name of a new weekly newsletter published by officers and men at Ross Field, Arcadia, California. It is now printed in multigraph form, but its material justifies a better dress and it is to be hoped that the editorial board will make it a regular sheet in the near future. We extend to the editors our cordial good wishes.

Mayor Smith Extends Welcome

John F. Smith of Lorimor, Iowa, who is an enthusiastic aeronautic supporter, informs us that he offers a cordial welcome to all cross-country pilots in that territory who visit the city of Lorimor. High test gas and lubricating oil is always available.

Pilot Abandons Siberian Flight

Prince Rupert, B. C.—Pilot Prest, of Nevada, who has been waiting here for favorable weather on which to hop off for the last lap of a flight from Mexico to Siberia, has abandoned the flight for this year following a second accident to his biplane.

His biplane, the Polar Bear, was wrecked in a gale September 29. It was carried 200 feet from its moorings and was badly smashed up. Prest said he intended to repeat his attempt next year, to fly from Mexico to Siberia, and will travel over the same route on which he so nearly completed the journey.

Flight to Encircle World Projected

London.—Capt. Sir Ross Smith, who made a successful air flight from England to Australia, will start shortly on an air flight around the world, according to the *Daily Mail*.

He will use a machine enabling him to alight with equal ease on land and water, and proposes, after crossing from Europe to Asia, to fly from Japan to Alaska, thence across Canada to Nova Scotia, possibly making a detour southward, visiting Chicago and New York, before heading for Nova Scotia.

Chicago Colored Girl Learns to Fly Abroad

Miss Bessie Coleman, a colored girl of Chicago, twenty-four years old, who had been studying aviation in France for ten months, arrived in New York recently on the American liner Manchuria. She brought with her credentials from the French certifying that she had qualified as an aviatrix.

Miss Coleman, who is having a special Nieuport scout plane built for her in France, said yesterday that she intended to make flights in this country as an inspiration for people of her race to take up aviation.

Dr. Ames on Aviation Development

"We must go ahead with the development of aviation in all its branches," states Dr. Joseph S. Ames of the National Advisory Committee for Aeronautics in an interview with the Associated Press. "The recent bombing tests of aeroplanes versus battleships off the Virginia Capes have served to indicate the great possibilities of aircraft in coast defense and naval warfare, and to accentuate the demand for progress in aeronautical development.

"There must be special development both in the Army and in the Navy for their respective services. Civil aviation must also be developed, for in the last analysis it should be the main support of the industry in time of peace. The first requirement for the development of civil aviation is that there should be Federal regulation of air navigation. A number of bills have been introduced in Congress to establish a Bureau of Air Navigation in the Department of Commerce, and it is hoped that Congress will take action at an early date."

Dr. Ames pointed out that in the present demand for economy in government there is danger that the development of aviation may be unwisely retarded. He states that economy can be wisely effected only where economy is possible without retarding necessary development, and that it will be a mistake to retard the development of aviation on the ground of economy in Government expenditures if it is at all possible to effect the necessary economies elsewhere. Continuing, Dr. Ames pointed out that in time of peace there must be an increase in scientific research and experimental investigations to assure that there may be any substantial development in aviation. Those industrial organizations which maintain research laboratories have recognized the imperative need of fully maintaining scientific research in times of business depression, the necessary economies being effected in other branches of their organizations.

"The aeronautic industry," said Dr. Ames, "has discontinued research laboratories which were once maintained by aircraft manufacturers, and in some instances manufacturers have even dispensed with their engineers and designers. The lessening of production has greatly reduced the volume of experimental work done by manufacturers, until now it is almost negligible. Under these circumstances, and in view of the fact that the governments of several European countries are supporting the development of aeronautics, it is essential that our Government should fully maintain scientific research in aeronautics.

"Civil aviation demands the development of cheaper, more reliable, and more efficient aircraft. The National Advisory Committee for Aeronautics has gone on record to the effect that without the continuous prosecution of scientific research and experimentation the development of aircraft for any purpose, for the Army or the Navy Air Service, the Air Mail Service, or for civil aviation generally, is impossible."

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, August, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
															Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
																hr. min.			
EASTERN New York-Chicago	$5,489.96	$997.92	$3,230.84	$3,095.20	$1,707.85	$638.00	$3,093.39	$1,616.73	$4,564.33	$4,853.57	$363.38	$1,615.65	$835.95	$32,102.77	14,211	475 51	42,196	$67.44	$0.76
CENTRAL Chicago-Rock Springs	5,702.40	1,508.37	2,786.78	4,111.09	1,472.85	336.85	2,478.49	2,341.48	6,352.50	6,046.60	526.27	2,339.91	1,210.68	37,214.27	21,255	761 10	65,528	48.88	.57
WESTERN Rock Springs-San Francisco	3,518.81	1,007.24	*14,930.52	1,808.10	1,034.72	231.07	2,751.57	1,616.73	3,847.37	4,108.82	363.38	1,615.66	835.95	37,669.94	12,352	459 29	41,708	81.97	.90
Totals and Averages	$14,711.17	$3,513.53	$20,948.14	$9,014.39	$4,215.42	$1,205.92	$8,323.45	$5,574.94	$14,764.20	$15,008.99	$1,253.03	$5,571.22	$2,882.58	$106,986.98	47,818	1,696 30	149,432	$63.06	$0.71

* Includes new motors in Planes No. 101 and No. 169, and new wings and ailerons on Plane No. 107.

Total Operating Cost	$106,986.98
Loss on unrepairable crashes	8,000.00
Permanent improvements	2,242.61
Grand Total	$117,229.59

Overhead consists of:
Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio; Testing and Experimental Work.
Maintenance consists of:
Miscellaneous; Mechanics and Helpers; Repairs and Accessories; and Warehouse.
Flying consists of:
Gas; Grease and Oil, and Pilots.

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern	$0.20	$0.26	$0.30
Central	.13	.21	.23
Western	.16	.20	.54
Entire Service	$0.16	$0.22	$0.33

E. H. SHAUGHNESSY, Second Assistant Postmaster General.



Central States Aeronautical Corporation Organized

The Central States Aeronautical Corp. has been organized in Indianapolis with a capitalization of $300,000.00. It is divided into two departments—the Engine Division and the Air Division. The Engine Division will have charge of the production of the "Peggy" Internal Combustion Engine, the invention of Mr. Samuel R. McBride, who served as an officer in the Air Service and later in the Engineer Corps. The Engine Division will also have charge of the production of the "Spencer" Engine, the invention of Mr. Owen H. Spencer, president of the Research Engineering Company at Dayton and formerly of McCook Field. The initial tests of these engines showed some remarkable developments which we hope to describe more at length in an early issue.

The Air Division will operate an air line between Indianapolis and Miami, Florida, during the forthcoming touring season.

This concern has among its personnel: Charles H. (Billy) Wilcox, Chief Pilot. Member of the Lafayette Escadrille, later at McCook Field on Caproni work, etc. Odis A. Porter, official timer of all sanctioned sped contests in the United States. Owen H. Spencer, president of the Research Engineering Co., holder of several patents pertaining to equipment for production work on Liberty engines, inventor of the Spencer engine, etc. Frank H. Dungan, production manager of the Spacke Machine Co. Samuel R. McBride, inventor of the Peggy engine, the Maybury propeller gear, the Hoosier mooring mast and the American airship structural designs.

Exports of New Planes and Parts

	Month of August			
	1920		1921	
	No.	Value	No.	Value
Aeroplanes			5	$47,165
Aeroplane parts		$2,120		15,005
	8 Mos. Ending Aug.			
	1920		1921	
	No.	Value	No.	Value
Aeroplanes	41	$381,204	35	$240,940
Aeroplane parts		507,358		128,578

Aircraft Plant May Be Built in America

It appears from a Washington despatch in *Automotive Industries* that the plea of the National Advisory Committee for Aeronautics for further researches into dirigible transportation will have a salutary effect upon the developement of this industry in the United States. The destruction of ZR-2, built in England for the United States Navy, brought about the resolution of the Advisory Committee and may result in the establishment of an aircraft plant in this country under the auspices of the Government, in order to conduct experimental work for obtaining definite information regarding the strength and quality of materials and girders used in the construction of airships and for the development and checking of theories used in the general design of aeroplanes.

Several groups of American financiers are deeply interested in the promotion of aerial transportation, especially through the use of rigid airships. Negotiations are now under way with the DuPont, U. S. Steel Corp., and General Electric Co., and other powerful financial interests for the establishment of dirigible routes to New York and Chicago. Several conferences have been held and experts employed by the syndicate have reported a system of dirigible transportation would be feasible and profitable.

Trade With Spain

The American Chamber of Commerce in Spain intends to edit in the early part of December a special number of its Monthly Bulletin and has requested us to publish this notice for the information of those who might wish to avail themselves of its special edition and contract for advertising space therein. Full particulars may be had from the American Chamber of Commerce in Spain, Rambla de los Estudios 8, Barcelona, or from Mr. Eugene L. Perea, care of Messrs. Boera Brothers, Staten Island, Ferry Terminal Building, New York City.

American Airways Active

The American Airways, Inc., operating a training school for air mechanics, and aerial "garage," at College Point, L. I., announce that they are in an excellent position to handle overhaul jobs for seaplanes which have had a hard season and wish to get fitted out for the winter. The facilities for this work are excellent, and all repairs, etc., are under the direct supervision of Captain T. L. Tibbs, formerly of the Aeromarine Airways. The work is all done on a basis of actual cost of material and labor, plus a twenty-five per cent charge for overhead. The result is high class work done very reasonably.

In addition to this, cadet-mechanics are able to do a great deal of the detail work which usually runs into considerable money and for this there is no charge.

The American Airways hangars are located on the Point at College Point, which is the promontory on the northeast of Flushing Bay and the East River. The building is part of the College Point Boat Corp., and is quite large and easily identified by wireless, flag and slipway.

Seaplanes will also be built reasonably, to order, as well as fast "aqua-sleds" with aeroplane motors and propellers.

Army Purchases Fokkers

The United States Army Air Service has purchased two twelve-passenger Fokker monoplanes, according to an announcement by the Netherlands Aircraft Manufacturing Company, 286 Fifth avenue, American representatives of Anthony G. H. Fokker, the Dutch aircraft designer. The planes, said to be the largest of their kind in the world, were shipped last week from Amsterdam.

The twelve-passenger F-4, as it is called, has a cruising speed of 110 miles an hour. The plane is equipped with a 400-horsepower Liberty motor. With a gasoline capacity of 120 gallons, the F-4, in one of its tests, flew more than 600 miles without landing, the announcement said. The planes are to be delivered at McCook Field, Dayton, Ohio.

A Remarkable Flight

The most remarkable long distance passenger flight in the history of aerial navigation was completed recently when the giant eleven-passenger flying cruiser "Santa Maria" landed at New Orleans after a complete circumnavigation of the Eastern section of the United States.

During this flight the "Santa Maria." which is the largest passenger flying boat in the world, has covered 18,000 miles in the air, and transported more than 2,000 passengers in absolute safety. In establishing this record-breaking standard of efficiency, she has been in the air during this trip a total of 270 hours. As far as is known, this achievement is unsurpassed by any other aircraft.

This outstanding flight commenced at Key West when the Aero-Marine Airways, with the co-operation of the United States Navy Department, undertook to fly the "Santa Maria" up the Atlantic Seaboard to Washington and New York, and thence overland about the waterways of New York State to Montreal, and along the Great Lakes to Chicago. From the latter city the "Santa Maria" proceeded to New Orleans along the valleys of the Illinois and Mississippi rivers.

While the total distance of this aerial voyage is probably not more than 5,500 miles as the crow flies, the "Santa Maria" made a large number of passenger flights at each of the cities she visited. Among her through passengers she has had a representative of the U. S. Navy throughout, first in the person of Admiral C. J. Peoples, and then Commander P. N. L. Bellinger of NC-1 fame. Both were specially assigned by the Navy Department, which fostered the flight as a means of aiding in the upbuilding of commercial aviation in this country.

Kloor of Balloon Fame Out of Navy

Lieut. Louis A. Kloor, Naval Reserve Officer of the naval air service, who commanded the balloon which landed in the Hudson Bay country last December and nearly lost his life, with his two companions, Lieuts. Farrell and Hinton, received orders from Washington detaching him from the service November 1, with leave of absence until that time. Lieut. Kloor did not take the examination last May for reserve officers, and the message was no surprise to him, he said.

It was said at Washington that the dropping of Lieut. Kloor was simply a matter of routine. In cutting down the navy personnel, it was said, reserve officers who did not take the examinations were the first to go, as it was assumed they did not care to remain. It is understood he intends to return to his home at Crowley, La., where he will enter the automobile business.

MacREADY'S ALTITUDE FLIGHT

IN a special despatch to the New York *World*, Lieut. John A. MacReady tells the remarkable story of his world's altitude record flight as follows:

"It wasn't a record I was after when I started out on the flight which ultimately resulted in upsetting Major R. W. Schroeder's altitude record, but to test a new propeller and additional equipment on the Moss supercharger, which has been experimented with extensively at Cook Field.

"One of the functions of the engineering division is the development of aeroplanes and equipment for military use at high altitude. Continual effort is being made to develop planes which will be better than the planes of other nations for combat or observation work at extremely long distances over the ground.

"My record flight yesterday was a test flight and the record was incidental to the very valuable engine, propeller and supercharger data which were obtained.

Day Was Ideal for Trip

"The day was ideal—warm and clear—just the sort of day on which the best results are obtained at altitude. The warmer the day is the better, instrument results are obtainable, because the pressure and density corrections do not bring the final height so low after all instruments are checked up and calibrated.

"After a good night's sleep to insure the best physical condition for the flight I arrived at the field and began at once to make immediate preparations toward insuring reliability of all factors which are necessary to obtain safety and comfort when undergoing the hardships which one encounters in this work. The mechanics had stripped the plane of all excess weight by cutting out unnecessary equipment and by reducing the ordinary gas capacity.

Unnecessary Gear Stripped

"The supply of oxygen was also reduced for the reason that in all previous flights I had flown with an observer, thus making it necessary to have an almost double supply of oxygen. Roy Langham had been my observer on all previous flights of altitude, but in this particular case it was not necessary for him to take readings, as the data to be obtained was such that I could get it myself with very few readings and observations.

"The plane climbed remarkably well considering the original slow speed of the propeller. This propeller was a very large one, having a ground speed of only 1,100 revolutions a minute, whereas most propellers have a speed around 1,600. The density of the atmosphere decreases with altitude, and a propeller turning slowly at the ground would have great speed as the plane rose more and more into the lighter air. On one previous flight the propeller speeded up from 1,450 r.p.m. at the ground to 2,400 r.p.m. at 34,000 feet, which was the ceiling of this particular flight; and on another occasion, when attempting an altitude flight, the propeller flew off the plane in the air, knocking off the air speed indicator, which was attached to the wing strut of the plane, and hitting the strut, because of this excess speed.

Had Been Trying for Years

"For more than a year I have been attempting to reach an altitude higher than has previously been made, but on all occasions something has broken while taking the plane up on the flight, and it has been necessary to descend in trouble. Oil pipes and bearings have broken in the engine, parts of the supercharger have flown off in the air, and the propeller has been lost in flight. The majority of these flights have been test flights around 25,000 feet for the purpose of obtaining data.

"Everything was functioning properly during the early part of this flight on which the record was broken. As altitude was gained I became more confident that success would be attained because in all flights I have made with the supercharger none had shown such excellent functioning during the early part of the trip. All the mechanisms were working in excellent order; I began using oxygen at approximately 20,000 feet, using it very sparingly at first in order that there would be sufficient in case of emergency.

"I was well protected against the cold. Over my military uniform was a heavy suit of woolen underwear and over this was a thick, heavily padded leather covered suit made of down and feathers. On my feet were fleece lined leather moccasins. My hands were covered with fur-lined gloves. My leather head mask was lined with fur and an oxygen mask was attached to it.

"The goggles were separate and were placed on the outside of the head mask. The inside of the goggles was covered with a film of secret gelatine compound which was painted over the glass. This gelatine compound is for the purpose of keeping the ice from forming on the inside of the goggles. It is supposed to function in this respect to a temperature of approximately 60 degrees Fahrenheit below freezing.

"In addition to the standard oxygen equipment of five flasks containing together a pressure of 2,300 pounds, I had an additional emergency flask containing a pressure of 1,500 pounds, which would lead directly from the flask through a tube into my mouth. At 10,000 feet I passed through a stratum of clouds and at 20,000 feet passed through another stratum which somewhat obscured the ground and hindered me in locating my position with respect to the geography of



© Underwood & Underwood

Lieut. J. A. MacReady just after he had broken the world's altitude record. With him are Dr. Sanford A. Moss, Capt. G. E. A. Hallett, and Adolph Berger

the ground. I did not feel any ill effects whatever until well above 30,000 feet, as I was receiving plenty of oxygen and was warm enough, but as the altitude above 30,000 feet was reached a slight slowing up of one's senses and faculties was noticeable and this slowing up increased as altitude above this height was gained. Any exertion calls for oxygen. The faculties do not function normally.

"If I would stoop over to make some adjustment I would feel the need for oxygen. This need is manifest by the objects on the ground and the instruments in the cockpit becoming dim and shaky. Whenever I felt these effects I would turn on a little more oxygen, which was flowing well and freely. I was worried at no time until approximately 39,000 feet was reached.

"At this altitude ice from my breath within the mask must have clogged the oxygen pipe, for the reason that I felt the force becoming diminished and began to feel very bad effects from its lack. I tried to blow this out and did succeed in getting a taste of ice, but could not act quickly enough to clear the entire tube, so swung over to the emergency flask and tore a small plaster from the side of my mask, placing the tube through this aperture directly into my mouth within the mask and in an instant was feeling comparatively normal.

"I was supercharging to sea level condition at 40,800 feet (indicated) and expected that flying on the engine alone I would probably reach 7,000 or 8,000 feet more, but this was not the case. As soon as sea conditions were lost on the engines the power was quickly diminished and I could only get 100 feet more altitude, which was the absolute ceiling of the plane.

"While hanging suspended at an indicated altitude on the dial of 41,200 feet the plane swung and rolled and very little action on the controls could be obtained. The controls were almost useless, as there was not enough sustaining surface to move the plane in the direction that was desired.

"It was at this point practically without control, and I held it there for almost five minutes before I was absolutely certain it would go no further. When assured of this I pulled the throttle slightly back in order to glide down, but even with this small movement the bottom seemed to drop out of the plane and down it quickly went toward earth.

Ice Now Blinds Goggles

"Before I could make the proper readjustments the engine and radiator had cooled so quickly that there was no warmth in the cockpit from the radiator pipes running through it to warm the pilot, and as a result it became much colder in the cockpit, resulting in ice forming on the inside of my goggles, making me almost blind for the instant, and I could not handle the plane correctly for a short time. I was feeling weak and groggy and was afraid of passing out completely.

"My mind was not active and I could not think fast and correctly. However, I knew that by reducing my altitude I would come back to normal and be able to make all adjustments if I could get down lower. I let the plane come down almost any way in order to get it down where I could think correctly.

"I neglected to say that just before or while I was at the supreme altitude that I remembered that Major Bane had asked me to look above me while at the great height and see if I could see the stars or any constellations and note the appearance of the sky and any peculiar features which might exist. This I did.

"I was unable to see any stars, but one fact was brought forcibly to my mind, and that was the fact that the atmosphere was extremely bright and light.

Sky Light Blue, Not Dark

"Instead of being a dark blue, as is the case at the ground, the sky was very light in color, with but a slight blue tinge. There is far more sunlight, and it is far brighter at this altitude than closer to the ground. Another point that I neglected was the fact that while climbing to the ceiling I was circling around the City of Dayton, gradually increasing the size of circle as altitude was gained in order to always be within gliding distance of the field or of Dayton. This circle as altitude was gained increased its radius until at the top of radius of about sixty or seventy miles. I attempted to keep this circle round, with Dayton as the center, but strong, heavy winds tended to drift me in various directions. I do not know what these directions were, for the reason that my mind was not sufficiently acute to be able to know all these facts.

"The original part of the return to earth was made in a very confused state, but as altitude was lost, elements of consciousness became clearer, and at about 30,000 feet I was beginning to feel normal again. Here I changed goggles and continued my glide toward earth, flying around at 20,000 feet for a period of approximately twenty minutes, in order that the change in condition from my altitude to the ground would not be too sudden.

Inventor Came Within 200 Feet

"I landed and taxied to the line where the boys in the hangars and on the field were waiting, curious to know the results of the flight. A pool had been made on the hangar, the different mechanics betting on the altitude. Dr. Moss, inventor of the supercharger, won the pool with a guess of 41,000 feet. The actual calibrated altitude of the flight, as indicated in the barograph charts, was 40,800 feet, which is the highest altitude any living being has made.

"I wish to again call attention to the fact that this record flight is but merely incidental in the chain of development of superchargers undergone by the engineering division of the air service and is the finished and perfected work of this development. Superchargers are in such a state now, due to the developing department under Major T. H. Bane, Capt. G. E. A. Hallett, Dr. S. A. Moss and Adolph Berger, chief of the power plant at the field, that they should be fairly consistent at extremely high altitudes in the future

"Yet, in my opinion, altitude records will not be gauged by the superchargers themselves, but by the physical limitations of the pilots. To get much higher, greater provision of some method will have to be made or it will be impossible for a pilot to sustain the extreme hardship."

LARGE GERMAN AIRSHIP STATIONS

By J. SABATIER *

THE strength of a country's air service does not depend simply on the number of its pilots and machines, but also on the character of its factories and its stationary plants (parks, airdromes, etc.). It may even be said that the latter elements are the most immediately necessary, for, though it is possible to improvise an air fleet quite quickly, as during the war, it is a much slower and more costly process to create the inner structure which alone can give the requisite stability.

For nothing, moreover, is there greater need of stations well equipped with tools than for airships. Thus, on going over the list of 73 airship hangars, which the Germans possessed at the time of the armistice, and the stations they have created, not only in Germany but also in Poland, Bulgaria, and Hungary, we cannot help thinking that a country possessing such elements of aerial power remains redoubtable, even though it has temporarily lost the airships once contained in these stations. It also makes us realize that our own country should have stations comparable with those of its rivals.

In this connection, it is profitable to examine the organization and equipment of the German airship stations. The stations best adapted for serving as the basis of this study were chiefly constructed by the German Navy, during the war, for exclusively military purposes and do not therefore entirely satisfy the conditions of exploitation required for a civilian air service. The requisite modifications for satisfying the latter conditions may nevertheless be readily determined according to circumstances.

General Plan of an Airship Station

This depends first on the number and kind of hangars it has. From this point of view, "L'Aeronautique" has already considered the advantages presented by orientable hangars (See "L'Aeronautique," for July, 1920). In spite of these advantages, the Germans employed during the war only one movable hangar, that at Nordholz. The dispositions made in various stations, notably at Schneidemuhl, indicate however that, if circumstances had permitted it, the employment of revolving hangars would have been much more common. It is, in fact, probable that the necessity of rapid and economical construction led our enemies to resort to the almost exclusive use of stationary structures with simple metal frames.

On glancing at the plan of a large German station, we are first struck by the large space occupied. At Nordholz, about 1200 hectares (3000 acres) are occupied by the maneuvering fields and their dependencies. The hangars themselves seem to have been dropped at random on this vast expanse, without any of the alinements or geometrical arrangements often found in other countries.

* Translated from "L'Aeronautique", by the National Advisory Committee for Aeronautics.

This disorder is however more apparent than real. The hangars are, in fact, generally constructed in pairs, each with perfectly free access at both ends. Besides, each pair is oriented differently from the others, so that, whatever the prevailing wind direction, one or the other of them is favorably situated for the entry or exit of its airships.

There are evident advantages in such a plan for the utilization of the airships, but unfortunately it leads to multiplying the hangars and distributing them over extensive fields. Besides, since the most accessible hangars vary according to the direction of the wind, it is necessary, in order to guarantee regular service, to have in each group one airship always ready to start, and a free place for any airship returning to port unexpectedly.

The most complete application of the above-mentioned principle is at the Nordholz station which has, in addition to its rotary hangar, three groups of hangars oriented at 120° with reference to one another. The distance between each group and the others is from 500 to 1000 m., making the maneuvering fields entirely independent of one another. There is room in each group for four airships, corresponding normally to one on the point of departing, two in reserve or being repaired and, lastly, to one place available for the reception of any airship returning to port.

We also find similar dispositions at Ahlhorn. However, in order to save space (500 to 600 hectares, instead of 1000 to 1200), the groups are nearer together and their landing fields partially overlap.

Let us note, in passing, that the employment of revolving hangars would have given the same facilities for maneuvering and, other things being equal, with less space and fewer airships.

Construction Details. Hangar Accessories

The existing large airships are about 225 m. long by 26 m. wide and 30 m. high. The newest German hangars are 260 x 75 x 40 m. and each can hold two airships side by side. A double hangar has great advantages. In the first place, it can be used as a single hangar in case a rapid increase in the size of airships should render it necessary. Furthermore, the maneuvers of entering and leaving the hangars would be facilitated by the greater width between the doorposts. On the other hand, the risk is greater in case of fire.

Each pair of hangars constitutes, in Germany, an autonomous whole, which is served by a standard-gauge railway and provided with storehouses and barracks.

This independence, which is still further accentuated by the considerable distance generally existing between the groups, is advantageous from the military point of view, since it limits the possible destructive effects of a fire or bombardment. It is more subject to criticism from the industrial point of view, because a more compact arrangement would make it possible to reduce the number of plants and facilitate their operation, besides economizing in the size of the field occupied.

The hangars, considered individually, should, above all, be designed with a view to facilitating the care of the airships contained in them. They should also be protected against fire.

In caring for an airship, it is necessary to go about without a light, not only around the balloon and its cars, but even inside the envelope, especially in the keel corridor. It is therefore essential that the daylight illumination of the hangar be well provided for. The light must also be well diffused, in order to avoid contrasts of light and shadow which greatly obstruct the view inside the envelope. In the German hangars, windows cover not only the side walls but also the roof and the end doors. They cover about one-third of the surface. The glass is colored yellow in order to reduce the chemical action of the sun on the fabrics.

By night, it is especially necessary to illuminate the floor and the roof of the hangar on account of the operations of propping and suspending the frame of the airship. Lamps must therefore be installed a few meters from the ground and also under the roof. The precautions prescribed for localities where combustible gases may accumulate apply also to lamps, to their wiring and to their accessories.

It is also essential for the good preservation of the balloon fabrics, and especially for goldbeater's fabrics, to avoid excessive dryness or humidity, frost or high temperatures.

Excessive dryness is prevented in summer by a systematic sprinkling of the hangar floor, combined with energetic ventilation. The cold and humidity are combated by means of a central radiator well spread out.

Lastly, the hangar walls are covered with heat-insulating materials (bitumenated cardboard and asbestos board), and the roof is provided with large ventilating chimneys. Each hangar has about thirty of these chimneys, which are about 0.6 m. in diameter, and can be closed by movable trap doors. The side windows have a movable part for creating air circulation about the balloons.

Said devices serve not only for the protection of the hangar against the heat, but also against fire, by the rapid elimination of the combustible gases escaping from the balloonets. This elimination is especially important during inflation and, above all, during deflation of the balloon.

The gas conduits (which are generally double and 0.5 to 0.6 m. in diameter) are buried under the floor of the hangar and are provided every 20 m. with strong branch valves. The connection between the stationary conduits and the balloonets is made by strong flexible sleeves from 6 to 7 cm. in diameter, terminating in dust filters. Precautions are taken to prevent the formation of dangerous sparks from the electrization due to the friction of the gas on the metal parts of the filters.

The gasoline is never handled in the open air. It is stored in subterranean reservoirs of 30 to 60 cu.m. capacity. The upper part of these cisterns is filled with some inert gas, generally carbon dioxide, which renders it possible to force the fuel into the portable distribution tanks mounted on wheels and provided with pumps and safety cocks. These tanks deliver the fuel to the various tanks on the airship.

Of course, the foregoing precautions against fire are supplemented by numerous fire extinguishers and a complete system of water pipes under pressure. There are, in general, on each side of the hangar, about every 50 meters, hydrants with two branches, provided with ordinary hose and nozzles.

Independently of the above dispositions, it is interesting to note the following accessories with which German hangars are generally provided. A tank of distilled water, capable of being heated, serves for filling the radiators. Piping for the distribution of ordinary water likewise serves for filling the ballast bags. One or two towers, of variable height, similar to the ones used in repairing telegraph lines, three or four portable ladders with adjustable inclination, numerous ordinary ladders and several connecting bridges enable access to the various parts of the envelope. Lastly, there are usually under the roof three longitudinal bridges along which run suspension rails, which serve as supports for the frames of airships held in reserve or being inflated.

Maneuvering Fields and Accessories

The maneuvering fields occupy, as we have seen, extensive tracts of land. Each group has, as a rule, two fields at each end of the corresponding hangars. The ground is leveled and carefully drained. All telegraph and other wires are put under ground and no obstacle is left to interfere with the work of the landing gangs.

For removing the airships from the hangars or for returning them, use is uniformly made of two guiding rails in underground conduits. Heavy cars run on these rails which hold them equally well either horizontally or vertically. The rails pass through the whole length of the hangar and extend into the field about 250 m., or a little more than the length of the airship. When the hangars are double and contain normally two airships, there are three rails, one of which serves both ships in common.

The guiding cars are mounted on ball bearings and are easily controlled, in spite of their weight. They are provided with a very rapid slacking device. Generally two of these cars are employed on either side of the airship, or four in all, but this number may be increased to six in case of bad weather.

This device seems to have given complete satisfaction, since it is uniformly employed in all German stations and since it has not been considered advisable to resort to screens, outside ports and devices for mooring in the open air, which are favored in France, and especially, in England.

On the landing fields and hangars there are, of course, night landing lights and meteorological and radio stations. In case of fog recourse is frequently had to a captive observation balloon.

Hydrogen Works

In concluding, we have a few words to add on the German hydrogen works. These plants have a capacity suspected by few persons in France. At Ahlhorn their capacity of production is 70,000 cu.m. per day. Let us recall, for the sake of comparison, that the large French works, based, it is true, on other processes, delivered during hostilities hardly 4000 cu.m. per day.

Most of the German works employ the so-called "iron" process, that is, the decomposition of steam by red-hot iron and the regeneration of the iron oxide by a current of water gas. Since this method requires highly heated furnaces, it is economical only when continuous. Since, however, its consumption is not regular, extensive facilities for storing the gas are necessary. Moreover, it is well to be able to transport and even to sell unrequired surplus. Developments in the use of this gas (for hardening oils, for various chemical processes, and, lastly, for autogenous welding) are favorable for the existence of such outlets.

It must be possible, at the stations, to inflate and replenish

the balloons very rapidly, if they are to render the greatest efficiency. It is, moreover, the question of inflation which precedes, in determining the plants, the question of replenishing. In fact, for a large airship of 70,000 cu.m., with a total theoretical carrying capacity of 50%, the maximum unballasting (fuel, ballast, bombs, etc.) during a voyage, is 15 to 20 tons. On its return, therefore, it must receive a fresh supply of 15,000 to 20,000 cu.m. of hydrogen. Under these conditions, unless for a particularly intense service, it is sufficient to hold in reserve 10,000 to 15,000 cu.m. of gas for immediate replenishing.

It is not exactly the same for inflating. It is assumed, in fact, that it must be possible to fill a large airship in 10 to 15 hours (The L-72 was filled at Friedrichshafen in 12 hours). At this speed, there is the advantage of not requiring so large a personnel and, above all, of facilitating the process of balancing, which might needlessly strain the frame of the balloon. It is, in fact, just so much easier to avoid a wrong distribution of the weight and lifting forces, as the means are more powerful for producing a rapid flow of gas into the balloon. It was probably for this reason that most of the German stations have a gasometer of 30,000 cu.m. and a battery of cylinders containing 30,000 to 50,000 cu.m. of gas under pressure, making a total of 60,000 to 80,000 cu.m., a volume practically equal to that of the largest airship.

It is then easy, as soon as an inflation is anticipated, to provide for completing the inflation from reservoirs, without furnishing the balance of the gas required at the end of the operation directly from the hydrogen works to the balloon.

It is, moreover, surprising how large a proportion of the hydrogen in Germany is stored under pressure. At first thought, it would seem, in fact, more economical to resort to the exclusive use of gasometers and thus avoid the expense of compressing, which absorbs about 0.5 HP per cubic meter. Nevertheless, the compressed gasplants of the German stations are interesting to consider. The containers are enormous cylinders 15 to 20 m. long by 1 m. in diameter, each holding about 1000 cu.m. of gas at 100 kg. They are stationary, on beds of masonry, and separated from one another by strong partitions. The whole plant is generally placed in a deep cave, sheltered from bombs. Lastly, in order to avoid explosive mixtures during the first filling, vacuum pumps are provided for removing the air from the reservoirs.

Due to these precautions, the reserve supplies in cylinders are little visible and little vulnerable. Their installation is rapid and easily modified. Lastly, there are no losses, such as may be very troublesome in using gasometers at long distances. Since there is little chance for the introduction of air into the cylinders, the purity of the gas is excellent. (The lifting force of the gas used in the L-72 was about 1188.)

Lastly, there exist in addition to the above described stationary plants, stores of portable cylinders similar to the French cylinders, and many tank cars, designed for running on ordinary railways, each holding from 1500 to 3000 cu.m. of gas.

The capacity of the hydrogen compression plants naturally depends on the productive capacity and exploitation conditions of their hydrogen works. It is not so much the inflations (relatively less frequent) as the replenishing and the needs of the service away from the central station, which determine the output of the compressors.

Ordinarily the 30,000 cu.m. of the gasometer would seem sufficient for the daily replenishing and for serving as a balance between the continuous production of the works and the irregular consumption of the balloons. In short, it is the needs of the outside consumers who, depending entirely on the compressed gas, determine the importance of the battery of compressors. At Nordholz the hourly output (1200 cu.m.) of the compressors differs but little from that (1000 to 1500 cu.m.) of the hydrogen producing works. The situation is about the same at Tondern (500 cu.m.). On the contrary, at Ahlhorn, where the gas production exceeds 2500 cu.m., the hourly output of the compressors differs but little from that of Nordholz.

Conclusion

We have reviewed the various organs required for the intensive exploitation of an airship station. They constitute altogether a veritable factory whose industrial character is clearly evident. As in every enterprise of this character, the cost of the first establishment is high. If, however, the plans are conceived on a large enough scale and methodically executed, the expenses incurred are rapidly amortized and the benefits of a favorable exploitation are assured. In this connection, it must be recognized that the Germans had a broad outlook in the organization of their airship stations.

ADMIRAL FULLAM ON THE ALABAMA TESTS

REAR ADMIRAL W. F. FULLAM (retired) discusses the recent Alabama bombing tests in a special despatch to the New York *Herald* as follows:

"The battleship Alabama was sunk at noon to-day (Sept. 26) by Martin bombers from the army air station at Langley Field. Four planes left the field, each carrying one 2,000 pound bomb, and three additional planes followed, each carrying two 1,100 pound bombs. The 2,000 pound bombs were dropped singly and the 1,100 pound bombs were released two at a time.

"The planes manoeuvered and fired from a height of 2,500 feet. The first 2,000 pound bomb struck the water near the ship abaft the beam. The Alabama was thrown over at an angle of 45 degrees and went down by the stern in thirty seconds, resting on the bottom of the bay with her upper works above water.

"Inasmuch as the six 1,100 pound bombs were dropped in pairs and the four 2,000 pounders singly there were seven distinct salvos in the attack, with four direct hits, a very big percentage. The last of the 1,100 pounders struck the Alabama amidships and completely wrecked the whole central citadel between the two masts. Both smokepipes were blown down and the foremast was bent over in a curve, with its top in the water.

"In her present condition the Alabama appears to be a much worse wreck than the Indiana, which has been a target for guns and bombs for many months. It is childish to attempt to discount this result by saying the Alabama is an old ship. No modern dreadnought could have survived this attack.

"As regards accuracy, the record of this last attack is remarkable in that all of the ten bombs struck within the danger zone—that is, within a distance that would have seriously injured the ship, either above or below water.

"The experiment to-day ends the bombing tests for the time being. The 4,000 pound bomb is being prepared at Aberdeen, however, and as soon as it is ready it will be sent to Langley Field. It is planned to send two, planes, one with the 4,000 pounder and the other with two 2,000 pound bombs, and drop them on or near the Alabama to give an idea of the probable effect of such an explosion upon the hull of a modern dreadnought. It will be the first experiment in naval history with a bomb of such size.

"Despite all efforts of conservative forces to minimize the importance of the Alabama experiments, it may be said that they corroborate the results of the tests against the German ships and furnish much additional information of the utmost value to the country.

"The officers and men at Langley Field, under the leadership of Gen. Mitchell and Col. Milling, have made a record of skill and devotion to duty that merits the highest commendation. The conditions have been difficult and discouraging in the extreme. Many skilled officers and men have been transferred or discharged of late and the available force has been so reduced that those remaining have been compelled to work night and day. It was the intention to sink the Alabama at night, but the necessity of completing all experiments at an early date and the physical impossibility of working the men night and day compelled a change of plan. Judging, however, from the success of the night tests with small bombs, we may be sure that the record of to-day's bombing with heavy projectiles would have been practically equalled at night.

"In closing it should be remembered that these important results that must logically and seriously affect our military and naval policy have been attained by the efforts of a few officers and men of the Army Air Service with old and inferior material, crude sights, and in spite of many obstacles and discouragements.

"The evidence is overwhelming that an efficient air force in conjunction with submarines, torpedoes and mines will suffice to protect the coast of the United States and its foreign possessions as well against invasion and against the attack of any hostile fleet that could be brought against this country."

THE RUMPLER 1,000-H. P. ENGINE

THE general arrangement drawings which are here reproduced show the main features of a 1,000-h.p. experimental aero engine which has been produced under the superintendence of Dr. Ing. E. Rumpler, of the well-known Rumpler aircraft concern.

It appears that as an aircraft designer Dr. Rumpler felt that existing aero engines had all been designed without a proper appreciation of the real needs of the aeroplane constructor, and in this instance he has set himself the problem of removing this drawback. He holds that the aero engine designers have been too rigidly obsessed by the fashions in favor with automobile engine designers, and that in their efforts aero engine designers have relied too exclusively on the use of superfine materials of extremely high strength to secure the necessary lightness.

It is, he holds, right and proper that the designer should employ these materials, but he should in the first place seek methods of construction and arrangement of parts such as to produce an engine fitted by its design for the special duties of propelling aircraft.

The 4, 6, or 8 cylinder in-line engine has many drawbacks for aero work. It is necessarily somewhat lengthy for the power developed, and hence encroaches on the space available for passenger accommodation or the like. The longitudinal moment of inertia is high, to the detriment of the manœuverability of the craft to which it is fitted.

To less and less extent the same disadvantages are alleged against the V and the three-row types of engine.

Neither does Dr. Rumpler consider the radial type, whether rotary or fixed, as ideal. The diameter of the engine is great, and therefore it is of unnecessarily high resistance. Also in the radial it is necessary to affix counterbalance weights to the crankshaft which represent useless load to be carried. Even if the radial be of the two-crank two-row type these balance weights are needed to some less extent, otherwise there is an unbalanced rocking moment set up.

In order to produce a really high powered engine which best compromises between the requirements of short over-all length and minimum cross-section resistance, which shall be of the least possible weight, and which shall have the most perfect balance possible, Dr. Rumpler has decided that it is necessary to combine the qualities of the radial and the in-line types.

Thus the Rumpler 1,000-h.p. engine is an engine with seven radial rows each of four cylinders, each plane of seven cylinders operating upon one of four crankpins of a four-throw crankshaft of the arrangement usual in four-cylinder vertical engines. This arrangement should—and it is claimed does—give the most perfect possible balance, together with low weight, small over-all length and a reasonable diameter.

The four cylinders of each line are held together by a block cylinder head, which carries the whole valve gear and the overhead camshaft for that line. This head block is removable for overhauls. Each ring of seven cylinders, with their water jackets, together with the corresponding ring of crankcase, appears to form a single unit casting, and the crankshaft bearings are carried on discs or spiders recessed into the crankcase segments.

Pistons are of compound structure, with steel skirts and aluminum alloy heads, and the big ends for each ring of cylinders are of the usual master-rod and wrist-pin type.

Four valves are fitted to each cylinder, all of equal size, and these exhaust to, or draw from, exhaust and inlet ports cast into the cylinder row head block.

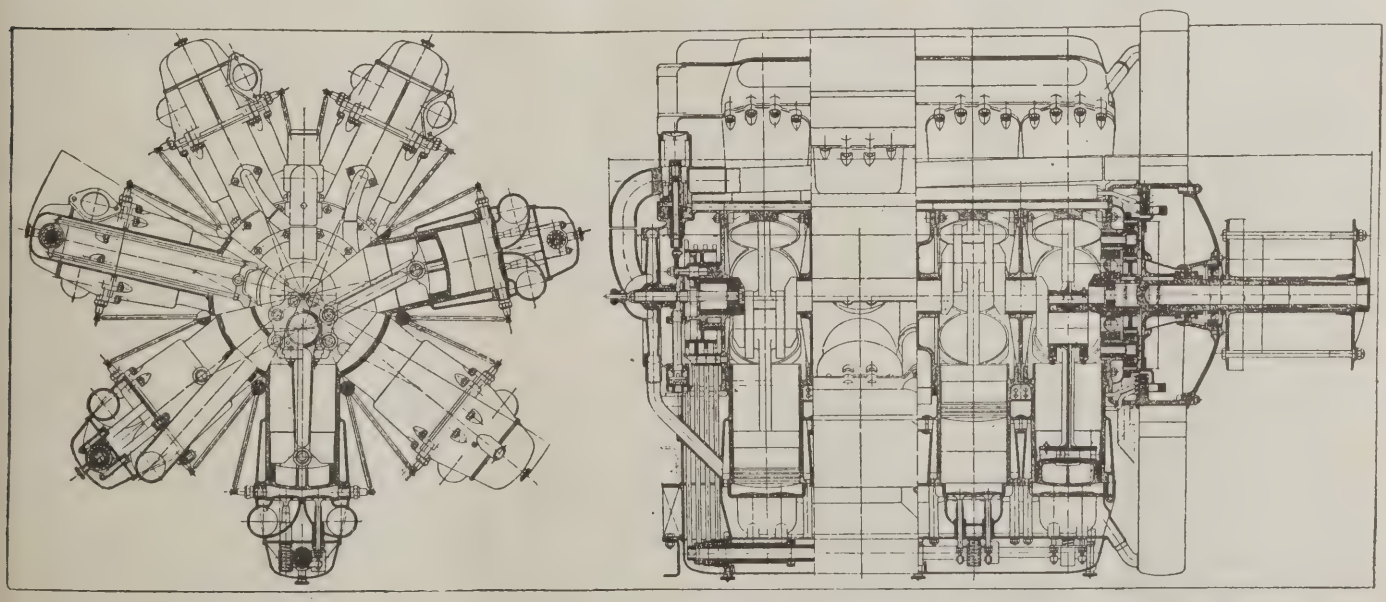
Although referred to as fitted with overhead camshafts, the engine is really fitted with a somewhat unusual type of valve gear. Four rings of cams, driven by an epicyclic gear are mounted concentrically with the crankshaft at the end of the crankcase farthest from the airscrew. These cams are of the push-and-pull type, and each ring operates one pair of push-and-pull rods for each of the seven radial lines of cylinders. Thus to each row there are four sets of these rods, each coupled to one of a set of four concentric camshafts, one for each cylinder in the row. These shafts rock, instead of rotating, and appropriate rockers on their ends operate on the valves of the cylinders of each of these sets of concentric rocking shafts; the outermost is the shortest and controls the valves of the cylinder nearest the cam gear. The next inward one extends to the next cylinder, and so on. Although somewhat complex in appearance this gear is undoubtedly simpler than would be the necessary arrangements for driving seven separate overhead camshafts of the usual type.

The engine is fitted with an epicyclic reduction gear housed at the end of the crankcase. This is of the single-stage type, of large diameter, and fitted with seven rows of planet wheels.

Mounted on the exterior of the reduction gear housing is a circular radiator. One single centrifugal impellor at the far end of the engine pumps cooling water through seven radial water pipes to each line of cylinders. The water passes along each line and enters the circular radiator at its circumference opposite the end of the line, and flows radially inwards to an inner cylindrical water space, and thence by a common return back to the pump.

What is obviously a plunger oil pump is shown at the valve-gear end of the crankcase, and a high tension distributor can be discerned surrounding the epicyclic reduction gear. Also two plugs are fitted to each cylinder. The only particulars of dimensions, etc., available are that the bore and stroke of each cylinder is 140 mm. by 140 mm., that the output is 1,005 h.p. at 2,000 r.p.m., and that the reduction gear is of the ratio 2:1.

The engine is undoubtedly interesting and ingenious. But it is very doubtful whether 28 cylinders, together with 112 valves, and with the necessary accessories for operating the said valves, for illuminating the 56 plugs, and for carburetting for 7 inlet manifolds can be justified even for 1,000 h.p. It is distressing to think of the probable language of a ground engineer faced with the task of giving this engine a "top overhaul."



Diagrams of the 1000 H. P. Rumpler Engine. Courtesy The Aeroplane

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

Indiana

Almost the entire state of Indiana is excellent flying country. The fields for the most part running north and south and east and west, and the highways being very pronounced every mile square. There is a strip running northeast from a little north of NORTH MANCHESTER, that is a little rolling and the section around the Lake regions is rolling. The section around LAFAYETTE is rolling. Southern Indiana is not so good. From SEYMOUR south, southeast and southwest, the country is hilly. The section west of a line between LOUISVILLE, KY. and INDIANAPOLIS, IND. and south of a line running between INDIANAPOLIS and TERRE HAUTE for the most part is rolling and hilly, particularly around BLOOMINGTON, BEDFORD, ORLEANS, etc.

Indiana for the most part is very good. Northern Indiana has a lot of fair fields.

CHICAGO to INDIANAPOLIS and INDIANAPOLIS to DAYTON is good.

The country from LOUISVILLE, KY. to EVANSVILLE, IND., is dangerous to within a few miles of Evansville.

On the Chicago-Cleveland route, passing over BRYAN, OHIO, the land east from the Illinois line to a point ten miles east of GARY, IND., is swampy or with a scrub growth or sand dunes, unless swinging around more than five miles south of Lake Michigan. In the balance of the route over Indiana there are short stretches of territory of probably not over ten per cent of the distance altogether, on which a dead stick landing without damage would be difficult, but not impossible, due to rolling terrain and numerous groves. The weather across Indiana, over the Lakes region in particular, is quite difficult during rainy seasons, but very rarely impassable.

Iowa

Taking the whole State in general, there is very good territory to fly over, being filled with open fields in which to land in case of engine or other trouble.

Iowa is all good land to fly over. A great part of it is practically level to slightly rolling. In the southern part of the state the land is generally rolling. What is known as very rough farming country yet there are high clear ridges everywhere so that from 2,000 feet one can always pick one running into the wind, which offers a good landing place.

Iowa (along Air Mail Route)—same as Illinois, i.e., flat country, but mostly given up to farming. Fields large enough but mostly plowed, but here pastures make for better fields. Western half of run, country is more rolling but still very good.

In the vicinity of CHEROKEE the land is hilly but a man can find places to land within one mile of town, that is, one mile south. Of course, this community is entirely agricultural. The land around PAULLINA and SUTHERLAND is flat and dry and landing fields are plentiful.

At IDA GROVE the country is hilly, but there is a pretty good landing field 1½ miles southwest of town on the top of a hill. Generally speaking, this section is very hilly and landing fields are not plentiful.

At ARTHUR, Ia., is a splendid landing field at the south edge of town and the country is fairly flat and unobstructed.

At Lakeview, Ia., the land is swampy near the lake, but west of town there is a good landing field.

At HOLSTEIN, Ia., the country is flat and dry, and landing fields are plentiful.

At MARCUS, Ia., the country is flat and dry and landing fields are plentiful.

At MILFORD, Ia., the country is a little rough and north of town there is a landing field, but it is small and swamps at the north end.

At ANTHON, Ia., the country is hilly and landing fields are scarce, but at the south end of town there is a hay field, plenty large enough to make a landing and the field itself is in good condition.

The air mail has a fine field at IOWA CITY, there is also a fine landing field on the north side of DES MOINES. The country from ATLANTIC, Ia., to OMAHA, Nebr., is a bit rough, but from a reasonable altitude a landing could be picked without trouble.

Along the Burlington R. R. (Chicago-Omaha route) as far as the Mississippi River, the country is perfect for landing, but from there until the Des Moines River is reached at OTTUMWA, Ia., the country is rather bad, but with plenty of altitude a safe landing would be possible. From Ottumwa the rest of the route is perfect.

From LINCOLN, Nebr., to ATLANTIC, Ia., one can land at any time from 1,500'. From Atlantic to DES MOINES, there is no fear of finding landing places. One can fly from Des Moines to OSKALOOSA and from there to Ottumwa, also landing at KNOXVILLE, Ia., and several towns south of the Des Moines River without trouble.

Kansas

LIBERAL to HUTCHINSON, level to rolling, some trees, farms, safe alt. 2500.

HUTCHINSON to WICHITA, gets rougher, more timber, air fair, farms still plentiful.

WICHITA to TOPEKA, gets hilly, more timber and objects, less emergency fields, alt. safe 4,000'.

TOPEKA to KANSAS CITY, little worse, about same.

Kansas is practically all excellent land to fly over. In the southern part of the State one needs to be careful about striking rocks in landing or taking off, but the fields are level.

In the eastern part of Kansas, south of KANSAS CITY and 50 miles west of the Mo. line central part very good, remainder good.

On a line from KANSAS CITY to WICHITA, KANSAS is good flying country. From Wichita and PARSONS, KANS., south to TULSA, OKLA., is pretty fair flying country.

Kentucky

That portion of Kentucky from CLARKSVILLE, TENN., to LOUISVILLE, Ky., is rolling and in lots of cases very hilly.

From DAYTON, Ohio, to LOUISVILLE, Ky., is extremely poor, especially after leaving HAMILTON, OHIO. From that place to within about twenty or thirty miles of LOUISVILLE does not contain even one good landing field in case of motor trouble. The country about one hundred miles Northwest of PADUCAH, Ky., is bad, continuing into TENNESSEE.

Country in square from PADUCAH to CAIRO and between MAYFIELD and COLUMBUS, very good—south of this in Southern Groves Country very poor—rolling and much washed, same as western Tennessee.

Louisiana

NEW ORLEANS to MERIDIAN, same as DEMOPOLIS to MERIDIAN, only more timber all way, few landing places, strip where there are none within twenty miles. Level, bad in spring, water everywhere.

NEW ORLEANS to MARSHALL, Texas, same as above, on nearing Texas line country gets hilly and rough. Timber and hilly Marshall. MARSHALL to TEXARKANA, Ark., a very poor strip, rough, timber, and lots of it.

Louisiana has some level flat country, but considerable amount of this is marshy. For the most part, the entire State of Louisiana is very bad flying country, with the exception of the extreme southern portion, the entire State being very wooded and marshy.

Between SHREVEPORT and HOUSTON, Texas, a pilot will find much wooded country, and places for forced landings few and far between.

East of river extremely rotten, miles of timber, cypress, swamps, etc. From Hammond south to the lakes one big cypress swamp. Northeast and northwest of Hammond all cut over timber. Good near BATON ROUGE for 15 miles.

No good landing fields near NEW ORLEANS.

Maine

Over the eastern corner of New Hampshire from NEWBURYPORT, Mass., to KITTERY, Me., it appeared to be very wet and swampy. Likewise the southeast corner of the State of Maine. After arriving north of BIDDEFORD, Me., there is some very good flying country each side of the Kennebec River for several miles. In this south central section of Maine there are plenty of very good fields with adjacent fields for use in emergency, some of the best fields in the state being in MADISON. In fact, there are very good fields in and around these towns: RICHMOND, WATERVILLE, SKOWHEGAN, MADISON, FARMINGTON, PITTSFIELD, DEXTER, DOVER, LEWISTON, EXETER and LIVERMORE FALLS

CARIBOU, Me., PRESQUE ISLE, FORT FAIRFIELD, HOULTON and, in fact, the entire Northern Aroostook County, is most excellent and has large farm fields until a few miles south of HOULTON. Thence to DANFORTH, Me., fairly poor. Wooded areas mostly and few fields. Thence to BANGOR, Me. Here the entire distance is very dangerous, consisting mostly of large forests and even after striking Penobscot River the chances are poor, although some fields are available. In the event of forced landing without injury over this section, there would be a question of being hopelessly lost in these very large forests. BANGOR affords excellent chances.

Thence to MONROE, Me., fair. Thence to ROCKLAND, Me., quite bad. Vicinity of ROCKLAND, O.K. Lots of

good fields here, but apt to be rather soft ground. Thence to Old Orchard Beach via BATH, Me., very good. Old Orchard Beach is one of the finest chances, but can be used only after tide is partly out. Hardly a chance for a fool to crack up there.

Thence to MANCHESTER, N. H., very good. Fields at Manchester not very good.

Maryland

From HAGERSTOWN to HARRISBURG via CHAMBERSBURG, CARLISLE and MECHANICSBURG, excellent flat landing fields all the way.

From YORK, Pa., to HAGERSTOWN, Md., O.K. part of the way, but approaches Allegheny ranges and rapidly becomes worse until it is really unfit for flying unless motor is sure.

Massachusetts

WORCESTER, ideal conditions, landing fields available should any engine or any other trouble force landing. If at an altitude of 2,000′ pilot could glide into a field at an angle, either BATTERY B FARM, HOLY CROSS COLLEGE GROUNDS or FAIR GROUNDS. The same applies to WORCESTER COUNTY.

SPRINGFIELD, ideal conditions, fields on outskirts include aerodromes at Eastern Aircraft Corp.

BOSTON, landing fields very poor, except in suburbs.

There are hundreds of fields in this state, connected with one another, over which a pilot could safely fly. GREENFIELD, drawing a line from KEENE, N. H., through GREENFIELD, Mass., through RUTLAND, Vt., the land covered is a good flying route, if reasonable altitude is kept.

From BOSTON to PROVIDENCE, R. I., one passes over country fairly evenly sprinkled with landing fields. Few should be used except as emergency fields. Among them is the Aviation Field at Rhode Island in PROVIDENCE. This is an excellent field.

BOSTON, locality, country rugged, south toward QUINCY, BRAINTREE, i.e., south shore toward CAPE COD. Neck of CAPE under irrigation, cranberry patches. Several safe landings for seaplanes. Air fair along coast line back toward BOSTON from CAPE, NANTASKET, hilly to rolling; Hull, lagoon, hilly; Paddocks Island, large rolling hills. HOUCHS NECK, Quincy Bay, the same. SQUATUM, Mass., old flying field, fair, air fair, dangerous over water. Hot weather, accident 1912, also balloon accident Quincy Bay 1911, "Stafford," cause bad air, hot weather, over water. Air conditions rugged to rough at Marblehead, good seaplane harbor, home of Burgess Company. All along this coast danger of "squalls" in summer, very sudden.

On flight across Massachusetts from SPRINGFIELD to WOONSOCKET, R. I., from an altitude of 7,000′ to 8,000′ no field fit to land in was observed. All woods and hills. Flying north from Woodsocket to LOWELL, Mass., and out the Merrimac River to NEWBURYPORT, there are plenty of suitable landing fields. Over the eastern corner of New Hampshire, from Newburyport, Mass., to KITTERY, Me., it appears to be very wet and swampy.

From FRAMINGHAM, Mass., to Connecticut the country is rough and many woods cover the ground.

From GREENFIELD, Mass., up to CONNECTICUT RIVER as far as CHARLESTOWN, N. H., there are any number of excellent fields to drop into that were probably once a part of the river bed. For a distance of perhaps three or five miles on either side of the river there are good places to land in. On the way to PETERBOROUGH, N. H., from GREENFIELD, Mass., there are a few poor stretches about ten miles from MT. MONADNOCK, both on the GREENFIELD side and the PETERBOROUGH side. In the general direction of KEENE, N. H. (from Grenfield), there are good fields.

Taking a direct course from ORANGE, Mass., to BOSTON, with the exception of the first ten miles, a pilot should not have any real cause to worry, as there are numerous fields along the entire course which would make good landing fields. The first ten miles of the course are extremely dangerous, being very much opposed to aviation in all respects, chief fault being only one field fit to land in; also a low altitude being troubled with air currents from the river. This, of course, applies to low powered machines.

From MANCHESTER, N. H., to WORCESTER, Mass., is very good. Excellent field there. Thence to SPRINGFIELD, very good and excellent field there. Thence to BRISTOL, Conn., fairly good and excellent field there, but on proceeding to DANBURY, Conn., conditions become not so good and hills increase.

Michigan

The country of Southern Michigan is rather swampy and there are many bad places in it, but if an altitude of 2,000 feet is kept a pilot would be in gliding distance of some solid ground. The fields in Michigan are generally small and lined with trees. It is said that more crashes occur here by motors failing on taking off than in any other way. There are spots that are absolutely level as prairie and have large fields. A good deal of the country is slightly rolling, but there are always fields which can be used in case of emergency. There is a section of territory extending about ten miles north and south between CASSOPOLIS and THREE RIVERS where a forced landing would mean a crack-up, as there is absolutely no place to land. The section of country around HILLSDALE is very hilly, but a landing can be effected.

Michigan on a line south of BAY CITY is very good and landing fields very numerous.

Within thirty miles north of GRAND RAPIDS and most of Southern Michigan is farm lands which are possible not only to land in, but also to take-off.

There are wide portions in Northern Michigan where pine lands make it extremely dangerous because of no landing fields, but these can be avoided by following the Pere Marquette and also the G. R. & I. Railroad as far north as PETOSKEY, and there are available landing fields all the way up.

Minnesota

Land almost anywhere east of MOORHEAD, Minn., is good for 20 miles, then country becomes rolling and hard to find landing fields. Along central part of Minnesota, very good, and in flying from MINNEAPOLIS to FARGO best route to follow is along the Great Northern Railway, then MORRIS and LITCHFIELD, Minn.

MANKATO to TRACY, and vicinity, country is fairly smooth and the air conditions are real good, generally speaking. There are quite a number of lakes around here, and the landing fields are very good and fairly large. The air conditions are very similar to those at MAICH FIELD near RIVERSIDE, Cal., though the air is not so bumpy.

For a distance of one hundred miles west of MINNEAPOLIS, the presence of many lakes and considerable timber makes the possibility of forced landings a little more complicated. However, a pilot with average experience should have no serious difficulty in effecting safe landings if necessary.

Minnesota offers an excellent flying country, with large fields of wheat and oats and a great deal of pasture or meadow land, which makes an ideal aeroplane landing field. Under the worst conditions (those being growing grain) the worst one can look for upon being forced to land in one of these fields is the breaking of his propeller, and more often there is no trouble at all from a forced landing in a grain field, the only inconvenience being that at times the plane has to be hauled out on account of the possibility of destroying a great deal of grain, should one try to taxi around. This territory comprises the entire Red River Valley, which extends from the Canadian boundary to the Central Western part of the State and is a belt that runs north and south through the State and varies from 75 to 150 miles in width. The central part of the State and the southern and southwestern parts are made up of fine farming lands, which offer numerous pastures, thus making ideal spots for the aeroplane to land. There is a great deal of dairying in the southern part of the State and, of course, this helps the landing grounds. The northern and northeastern part of this state is covered by timber land, but there are enough clearings in this country so that it has been possible to fly planes almost everywhere without the slightest trouble. There have been no fatal accidents on account of landing in the trees in this part of the state.

A flying boat would be very popular on account of the thousands of lakes. On the whole the risk of an aeroplane flying in this state is a very good one.

The northern part of Minnesota has practically no emergency landing fields and is considered very dangerous land over which to fly. South of the line of ST. CLOUD will be found a pretty good flat farming, except along the Mississippi River, where it is quite rough. There are very few places along the river, however, where you cannot set a ship down and get it off. There are ten thousand lakes in Minnesota, and a flying boat could travel almost anywhere about the state and keep within gliding distance of water.

The western half of Minnesota, except in vicinity of Minn. River, good; near MINNEAPOLIS, poor; west of Minneapolis, except first 30 miles, good; S. W. and S. of Minn. River, all very good.

In northern Minnesota there are steady miles of large jack pines. One can fly for an hour and a half without seeing a passable landing field. Below central Minnesota are lakes and swamps by the hundred, country rough around MINNEAPOLIS and ST. PAUL, with many lakes.

From FARGO, N. D., to MINNEAPOLIS, good for first two hundred miles, bad from then on.

In and about TRACY and its vicinity, the country is very favorable to flying. There are a few hills, none of which are very high, a few lakes and some swamps. The lakes and swamps, however, ought not to give any pilot any difficulty providing he is flying at an altitude of 1,500′.

The country in and about TRACY and vicinity is composed mostly of pasture and farm land. In the summer one might have to contend with corn fields and grain fields, and of course, would at all times have to contend with fences and with telegraph and telephone wires. The conditions outlined as pertaining to TRACY and vicinity are true of the country surrounding Tracy for a considerable distance.

In and about NEW ULM and MANKATO one has to contend with the bluffs surrounding the rivers. Again, if the pilot has sufficient altitude he ought not to have any difficulty in making a forced landing. There is one hangar and a very good landing field at TRACY and it is a good field to make and land at on any cross-country flight.

At JASPER, Minn., there are piles of rocks scattered around, but at the east edge of that town is a hay field or pasture suitable for landing.

At BROOTEN the land is fairly flat and there is a good landing field at the southwest edge of town.

Between BROOTEN and PARK RAPIDS, MINN., the land is flat but is swampy and timbered, and landing fields are somewhat scarce.

At ORTONVILLE the land is very hilly and about the best landing field is a field two miles north of town.

At PARK RAPIDS, Minn., the country is flat but is swampy and abounds in forest and scattered trees and landing fields are not plentiful, but at the west side of town is a race track where one can land, but has to be careful because there are bumps in the field.

Between PARK RAPIDS and BEMIDJI the country is very hilly and covered with forests.

From CHICAGO to MINNEAPOLIS-ST. PAUL over LA CROSSE, Wis., the route lies over fairly level and open territory as far as the WISCONSIN RIVER, from there on northwest the country grows rapidly rougher and with heavy timber till the last fifty miles out of LA CROSSE has only scattered possible landing fields. From LA CROSSE up the river valley or over the highlands to the west of river possible landing fields are available from an altitude of two to three thousand feet. The territory from the WISCONSIN RIVER northwest has days when low fog and rain make it impassable but these days are actually not numerous. In winter time this route suffers from very cold weather and blinding snow storms, some of which are practically impassable. This route does not suffer from prohibitive winds.

Field of Curtiss Co., between ST. PAUL and MINNEAPOLIS, north of river near Fair Grounds, Mail Field, south of river with big cement race track. Country directly west of Minn., rather poor for 30 to 50 miles, then good on west. North of this bad place it is good as far as Souk Centre. To the N. E. it gets more wooded, but west and N. W. towards BRECKENRIDGE it is good.

WHAT AIRSHIPS CAN DO

IN a special article in the London *Observer*, Major C. C. Turner, the well-known British aeronautic authority, presents some timely thoughts on the subject of airship transportation.

Excepting the passenger airship services of Germany before the war there has been no test of airship line possibilities. Germany is favored by nature for airship work, moreover; and in those services there was no strict requirements as to speed and daily regularity. On the other hand, the ships engaged would now be regarded as obsolete. The services were run with ulterior war objects, and for the maintenance of a fleet and the training of personnel. They were successful in so far as no passengers were lost or injured.

With the victory of the Allies, airship work by the Germans, who had most of the experience, came to an end, and it was left to Great Britain, France, and Italy. In all these countries, however, it has been half starved.

The R-38 must not be taken as an example of the best that could be done. It was designed for war of a special character and conditions, and it is highly probable that if the Germans had been presented with the same proposition they would have designed something very like it. The disaster can hardly fail, however, to lower British airship prestige; and it would not be surprising if America should now make a fresh start from the pure Zeppelin model. It is said that negotiations are now in progress for a Zeppelin of 3,500,000 cubic feet. A very different ship than the R-38 would have been built in this country for an airship passenger line, for which it is certainly not necessary to have an altitude capacity to 25,000 feet.

During the trials of the R-38 she attained a speed of 50 knots, or 57 miles per hour, with only three-quarters of her power; and this marks an advance in the most important direction, and shows there is no inherent impossibility of improvement of the speed of airships. The speed hitherto has been disappointing, because it has had to be sacrificed for fuel-economy, and to some extent also to structural requirements. Like everything else mechanical, the airship embodies compromises. But it must be admitted that the theoretical maximum speed of no airship type has been obtained, except briefly and on rare occasions. Thus, the R-34 in crossing the Atlantic, although the engines were only once worked "full out," and for nearly all the time the voyage was made at lower than "economical" speed, consumed far more petrol than was anticipated, and reached New York with only ten gallons left. The air speeds in the log show that at the start, with all engines working, 55 knots were "made good"; there was a following wind of 25 m.p.h., so that the air-speed was about 41 m.p.h. Thereafter the following air-speeds appear in the log, the figures being here converted into miles per hour:—43½, 45, 36½, 34, 41, 41, 39, 41, 41, 24.

German Criticism

The capabilities as well as the design of airships must be put to very searching criticism, for it is only after this preliminary that progress will be attained. In Germany the voice of criticism has not been silent, and it is asserted that no sure method exists of determining the amount of ballast necessary for a voyage of any considerable length, and that so long as the discharge of ballast is necessary to compensate for atmospheric variations long journeys will always be a matter of luck. Some of the accidents are, it is said, traceable to this cause. It is also pointed out that the "useful load" estimates are always based on sea-level figures, and that at 10,000 ft. it is only about two-thirds as much (as explained in these Notes last week). Yet on long journeys an airship, apart from the need to cross mountains, would have to range up to 8,000 or 10,000 ft.

Of eighty-three Zeppelins employed during the war thirty-four were shot down and destroyed, two were accidentally destroyed on entering or leaving sheds, thirteen caught fire accidentally, ten were destroyed in emergency landings, four owed their loss to failure of engines, one was destroyed by lightning, and one broke adrift and disappeared. It is remarked that of the thirty-four brought down by enemy action, some would otherwise have been lost from the other causes specified.

Some of this criticism is met by the mooring mast, which makes it easier to berth an airship and, being comparatively inexpensive, can be provided at numerous points.

It should be explained that an airship, in addition to the lift provided by its gas, can be given a certain amount of "dynamic lift" by means of its speed and the operation of its elevators; but ascent, by whatever means, involves expansion and loss of a certain amount of gas, whilst descent suddenly below static equilibrium may impose exceptional strains on the structure owing to diminished interior pressure.

Solid Claims

The airship, being capable of remaining aloft for long periods, does not need such high speed as the aeroplane. It need not make a straight course, but can avoid unfavorable currents and take advantage of helping ones to some extent. More experience is admittedly required, and accurate wind forecasts. With these much will be possible, for it is very rarely that a wind blows even for a short period over a front of as much as 1,000 miles. It is, however, a fallacy to suppose that there is always a favorable current at some altitude; and even if there were, an airship cannot do much ascending or descending without loss of ballast or gas. Again, it is fallacious to take into account merely the average strength of the wind in any region. Thus, one is told that the average adverse wind in the North Atlantic is only ten miles per hour; and that "therefore an airship of 50 m.p.h. can——," and so on. What must be taken into account is the number and incidence of the days when the wind exceeds a certain velocity.

But to point to the advantages of airship travel is really unnecessary; it is universally understood. There is one point, perhaps, that has not yet been widely grasped, and that is the beneficial reaction it would have upon steamship services. Steamship travel will both be cheapened and increased by airship services. For one thing, high-speed passengers will not have to be catered for, so that coal will not have to be burned extravagantly. Steamships, therefore, could be built on economical lines for ordinary passengers and cargo; and steamships will be one-class boats, thus getting rid of distinctions that become irksome on long voyages, and also making for efficient and economical management.

NAVAL and MILITARY AERONAUTICS

Construction of ZR-1 Progressing

Washington—Loss of the giant British-built airship ZR-2 with many lives on her trial trip in England has not thus far caused any change in plans for the ZR-1 now building for the navy. The two designs were so dissimilar, it is said by navy officials, that the wrecking of the ZR-2 carried with it no lessons so far as now known to be woven into construction of the ZR-1 as a safeguard against similar disaster to that vessel.

The ZR-1, it is explained, is the American navy's pioneer project in airship construction of the rigid type and the vessel follows very closely the design of the German Zeppelin L-49, captured intact in France during the war. Modifications to permit installation of American made propelling engines and a few other changes were necessary, but navy officials regard the ZR-1 as practically a reproduction of the L-49, which was proved by the Germans as a safe and reliable craft with all stresses and strains demonstrated in actual flight under varying conditions.

It was the purpose of the navy experts to make the L-49, which was almost the last word in German war experience construction, the starting point for American development of lighter-than-air rigid war craft. On the experience gained in operation of the ZR-1 it is planned to base future improvements or increases in size.

The ZR-2, on the other hand, represented the last word in British engineering progress over German originals, and the disaster to the British-built vessel officers here feel, only tends to confirm the decision to attempt no unexplored field of construction in turning out American Zeppelins, but to proceed from one well established model to the next improvement slowly and so on, step by step, to whatever the ultimate lighter-than-air cruiser of the future is to be.

Construction of the ZR-1 is said to be going slowly by reason of reduced appropriations for the navy this year. Practically all of the duralumin for girders of the ship's framework has been produced and is now in process of fabrication into the latticework frame members at the Philadelphia aircraft plant of the navy; contracts have been let for the eighteen gas bags which will furnish the lifting power, and the keel of the ship will be laid within a few months at the Lakehurst, N. J., hangar built to house both the ZR-1 and ZR-2.

The frame members are being cut and assembled at Philadelphia, to be knocked down when complete and shipped to Lakehurst, where they will be reassembled and placed in the ship.

The gas bags are designed for either hydrogen or the new non-explosive but highly expensive helium gas discovered during the war. At present plans call for the use of hydrogen because of the excessive cost of producing sufficient helium to fill the bags to their full 2,000,000 cubic feet capacity.

The ZR-1's 645 feet in length and 78 feet in diameter practically duplicate the standard German practice, as shown in the L-49, which was produced after the Germans had operated some 140 aircraft of the Zeppelin characteristics in actual service. In speed, however, the American craft is expected to exceed the sixty-mile maximum of her German prototype, due to use of higher power. Present plans call for the use of six Liberties, each in a separate car, as against the original plan for five engines, two of them driving the stern propeller and mounted in the after car. The motors were designed to deliver 400 horsepower each for aeroplane use, but for employment in the ZR-1 will be reduced to 320 horsepower each, with a consequent improvement, it is said, in economy and reliability of operation.

While the ZR-1 will have virtually 700,000 cubic feet less gas capacity than the ZR-2, her lift is expected to equal the 56-ton pull of the British trans-Atlantic R-34, and to be about twenty-seven tons less than the ZR-2. The American designers have been unable as yet to make what they regard as accurate calculations as to the useful load—the tonnage in excess of her own weight equipped for flight—the new ship will be able to carry.

Drop 4,300-Pound Bomb

Baltimore—The largest, fully charged demolition bomb ever made was exploded September 30 at the Aberdeen Proving Grounds by the Army Aviation Service with prominent officers of the navy and army as witnesses. The bomb weighed 4,300 pounds and was dropped from an altitude of 4,100 feet. It landed within the area marked off and left a crater 100 feet in diameter by 30 feet deep.

The observing party was on an elevated platform, 1,500 feet from the spot. They felt no unpleasant sensation and nearly all agreed that the effect on their eardrums and nerves was not severe. Marshland was chosen for the test.

Captain Carolin was the pilot and Sergeant Smink and Corporal Avariet the bombers. A specially constructed rack device held the bomb, and when the bombers reached the desired altitude the gentle pull of a lever released the big missile. It was about 13 feet long, 2 feet in diameter and colored red with a yellow tail. The coloring was to enable the observers to study the motion of the bomb.

Changes in Navy News Section

Lieutenant Commander Wells Hawkes, U.S.N.R.F., has been directed to report to Secretary Denby with a view, it is believed, of taking charge of the Navy news and information section. Mr. M. H. McIntyre, a Washington newspaper man, who has been in charge of the Navy news section for over three years, severed his official connection with the department on September 1 and has inaugurated a news service covering special Navy news and photographic features. Mr. McIntyre joined the committee on public information in 1918 and has rendered valuable service to the department in the dissemination of news. He has been of great assistance to the newspaper men who "cover" the Navy Department.

ZR-2 Disaster Laid to Faulty Designs

Lack of proper co-operation and supervision when designs of the dirigible ZR-2 were first drawn, and the later failure to submit the changes in design to closer scrutiny, are blamed for the disaster of the big airship in the report of the Air Ministry's Board of Inquiry, which was issued October 7.

It was simultaneously announced that the Admiralty was beginning an inquiry on its own account to determine just what happened when the airship's designs were first drawn under the stress of war, and the course of events until they were turned over to the Air Ministry, October 1, 1919.

Commander Dyer, U. S. N., who represented the United States Government during the building of the airship, sat with the inquiry board as "in attendance," but did not sign the report. The report reveals very little not already published, but places the blame, if blame there was, upon the "pioneers"—most of whom perished in the disaster—responsible for trying to turn out an airship to beat the Zeppelins under England's constructional facilities.

In describing the accident the report says that under the tests the airship was made to execute sharp turns at forty-five to fifty knots, which brought the breakdown between the ninth and tenth frames. It says that the fire started from sparks caused by broken electric "leads" coming in contact with broken petrol "leads," the fire spreading throughout the keel, setting off the oxygen.

The electric installations were all in the forward part of the ship. No fire broke out in the after part of the ship, in which four of the five survivors came down safely. Then follow these significant paragraphs:

"That the requirements as to the maximum height and speed, together with the limits of length imposed by the only available construction sheds, necessitated the utmost economy at Hull in the matter of weights and materials. Many new features were introduced in the design, and it appears evident that in some cases there was a lack of vital aerodynamical information as to the effects of these modifications on the strength of the structure.

"That having regard for the great differences in requirements between His Majesty's airship R-38 (the British name for the ZR-2) and previous British airships, the design should have been examined and discussed by an official and competent committee before actual construction was commenced. There is no evidence to show that this was done, though the opportunity arose after the armistice, when information as to the details of ships built elsewhere became available.

"That the system by which both construction of the ship and the inspection work was centred under one head, as was the case at the Royal Airship Works at Cardington, is unsound.

"That, although there can be no doubt that efforts were made toward the end to complete the ship in the shortest possible time, there is no evidence that the work on the hull or structure suffered."

FOREIGN NEWS

The Soviet Acquiring Airships

According to the *Epoca*, the Russian Soviet agent, Vorowski has purchased two of Italy's airships, which are to go direct to Moscow.

German Aeroplanes for Sale

According to the Amsterdam correspondent of *The Times*, advertisements have appeared in the Dutch press, offering for sale 36 new German aeroplanes. The machines are stated to be equipped with 200 h.p. Benz and 120 h.p. Mercédès engines.

Record of the Fokker European Airlines

The following statistics of the Fokker European airlines are immensely interesting as demonstrating the safety and reliability of aerial transportation:

Line	Route in miles	No. of Trips scheduled	No. of Trips carried out	Miles Flown	Accidents involving injury to persons or loss of freight
London - Rotterdam - Amsterdam V. V. Period: Apr. 14—Aug. 28.....	265	243	230-95%	61,000	nil
Rotterdam - Amsterdam - Bremen - Hamburg V. V. Period: Apr. 14—Aug. 1.	280	186	176-95%	50,000	nil
Danzig - Konigsberg - Memel V. V. Period: Apr. 1—Aug. 1.....	180	242	233-96½%	42,250	nil
Extended during August to: Danzig - Konigsberg - Memel - Riga V. V. Period up to Sept. 1.....	270	54	54-100%	13.350	nil
				166,600	

More German Soaring Records

Following on Klemperer's 13-minute flight on August 30th, on September 6th Herr Martens, flying the Hanover (Pröll) monoplane, put up a new record by leaving Wasserkuppe and remaining in the air for 15 minutes 40 seconds, and covering a distance of 7.2 km. (This distance appears to be a straight line measurement, and not as in the Klemperer figure of 9.6 km. a flight path measure.) The wind was between 5 and 7.5 metres per second, and for 11 minutes 30 seconds the machine kept at or above the level of the start. A landing was made near Batten, 410 metres below the starting point.

On September 5th, a Herr Harth made a flight of 21 minutes, landing only 12 metres below the start, and on the 6th the same pilot flew 22 minutes, finishing with a dive and crash.

University Courses for British Officers

In order to afford R.A.F. officers facilities for advanced technical studies, arrangements have been made for a limited number of officers to attend certain courses at the principal Universities in the country. These courses have been instituted mainly to enable officers to qualify themselves for technical duties in engineering, wireless, navigation research, and other branches.

The courses are as follows:

(a) Special Course in Engineering subjects at Cambridge University.

(b) Post-Graduate Engineering Course at the Imperial College of Science and Technology.

(c) Special Course in Aeronautical Research. This course is also held at the Imperial College of Science and Technology.

(d) Courses in Mathematics and kindred subjects at Universities in the United Kingdom.

Whilst attending these courses officers will receive full pay and allowances of their rank and will be required to pay all personal expenses. Those taking course "D" will also be called upon to pay all University and other fees, and those taking course "B" to contribute £20 towards the fee payable to the College.

An officer will not be eligible to attend a University course unless he holds a permanent commission, and fulfils certain other conditions.

The South African Air Force

The S.A. Air Force, with headquarters at the Swartkops Flying Station, Pretoria, has two hangars, six machines and six trained pilots.

There are at Pretoria now eighty commandants from various parts of the Union undergoing military training and they are taking a great interest in the air depot. They were agreeably surprised when it was explained to them that 112 aeroplanes with every sort of spares and equipment had been made a free gift to the S.A. Air Force.

In October, a committee under the Minister of Defense will select additional personnel. They have already had 1,500 applications for the ten flying officers' appointments and 10,000 applications for enlistment.

Commissions, which are for three years, and may then be renewed, are available from the ranks. The selected candidates will receive six months' training at a military establishment, six months at the air depot, six months at a flying station and six months actually learning to fly.

Pilots must be between 18 and 30 years of age.

In addition to Pretoria there will be stations at Bloemfontein and Maritzburg. It is proposed to use aircraft in co-operation with the police in the Transkei and Swaziland.

The Commandant S.A. Air Force is Colonel Sir Helperus van Ryneveld, K.B.E., D.S.O.

Meeting of the F. A. I.

The next meeting of the International Aeronautical Federation (F. A. I.) will take place October 26 to 28 next, at Madrid, Spain. The meeting will be attended by delegates from the eighteen countries which possess active affiliated aero clubs, namely, Argentine Republic, Belgium, Brazil, Czecho-Slovakia, Denmark, France, Great Britain, Italy, Japan, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United States and Uruguay. Two of the affiliated national bodies, those of Egypt and Russia, are considered inactive, while three ex-enemy countries, Austria, Germany and Hungary, were excluded from the F.A.I. during the late war.

Among the subjects which will come up for consideration at the Madrid meeting will be the re-admission of the ex-enemy countries, particularly of Austria, which is urged by the affiliated bodies in Spain, the Netherlands and Sweden. Requests for affiliation have been received from Finland, Haiti-San Domingo, and Shanghai. The provisional admission of Chile and China decreed by the previous meeting of the F. A. I., on January 9, 1921, will be submitted to ratification.

British Aerial Transport Figures

From May, 1919, to March 31, 1921, 63,975 civilian aeroplane flights were made in the United Kingdom, averaging 19 minutes per flight. The planes flew a total of 1,593,700 miles in those 23 months. More than 170 tons of freight and 110,388 passengers were carried. There were 2,315 departures for the Continent and 2,191 arriving planes in Great Britain. In that period imports totalled in value 818,553 pounds sterling. Exports aggregated £402,776; 84,607 letters were transported from November, 1919, to March 31, 1921. From May, 1919, to March 31, 1921, there were eight fatal accidents, 18 non-fatal accidents, and 20 accidents in which none was injured. Fatality rate per thousand passengers was 0.10. Non-fatal accident rate was 0.14 per 1,000 ppassengers.

French Air Transport Figures

It is reported that civilian air lines in France imported 2,041,400 and exported 660,200 francs worth of merchandise during the first quarter of this year; 22,000 letters were carried in the same period. Between March, 1919, and March, 1921, the fatality rate from accidents was 0.10 per 1,000 passengers. Injuries rated 0.14 per 1,000 passengers. The French Commercial Air Company carried 6,697 passengers in 4,428 flights over 1,590,000 kilometers.

New German Combine

It is reported that the Aero-Union A. G. Berlin has just been founded with a capital of 12,500,000 marks, of which the "Allgemeine Elecktrische Gesellschaft" are taking over 5,000,000, the Luftschiffbau Zeppelin G. M. b. H. Friedrichshafen, 2,500,000 and the Hamburg-American Line 4,998,000 marks. The objects of the company are air transport at home and abroad, sale of aircraft and operation in all lines.

German Air Transport Figures

It is reported that from February 5, 1919, to November 26, 1920, German aeroplanes covered approximately 1,000,000 kilometers and conveyed 5,545 passengers, 453,000 kilos. of freight, and 35,000 kilos. of air mail.

Dutch Operations

Dutch newspapers state that commercial aerial transport of both passengers and freight has become so popular that the lines will continue to operate this winter.

Vickers Activities

There is quite a lot of activity as regards aircraft at the Brooklands works of Vickers Ltd. just now.

The "Viking IV" (450-h.p. Napier "Lion") has completed her flying and water tests, and has given great satisfaction. The water tests were carried out on the Solent, with Capt. Cockerell as the pilot. There are no fundamental differences in design between the "Viking III" and the "IV," but there are alterations and modifications in the detail design. The wings are of slightly larger span and chord. Instead of the service petrol tank protruding above the centre section of the top plane, it has been redesigned to form part of the centre section, with an improvement in appearance and a lessening of head-resistance. The beam of the hull is greater, so that the cubic capacity is slightly greater. The wing floats and undercarriage struts have been redesigned, and the engine is fitted with a very efficient self-starter, which started up the "Lion" on the first turn of the handle four times in succession during a recent test. The tail surfaces are the only prominent feature which remain as before. Some "Vikings" are fitted with folding and others with non-folding wings.

Two "Viking IVs" have been ordered by the Dutch Government for use with the Dutch Navy, and it is understood that they will be sent to the Dutch East Indies, where they will be used for "spotting," etc., with ships.

Their range at about 100 m.p.h is 900 km. (about 560 miles), and their top speed is a few miles per hour more than 120. These machines carry wireless, and are fitted with two Scarff gun-rings, one fore and one aft of the wings.

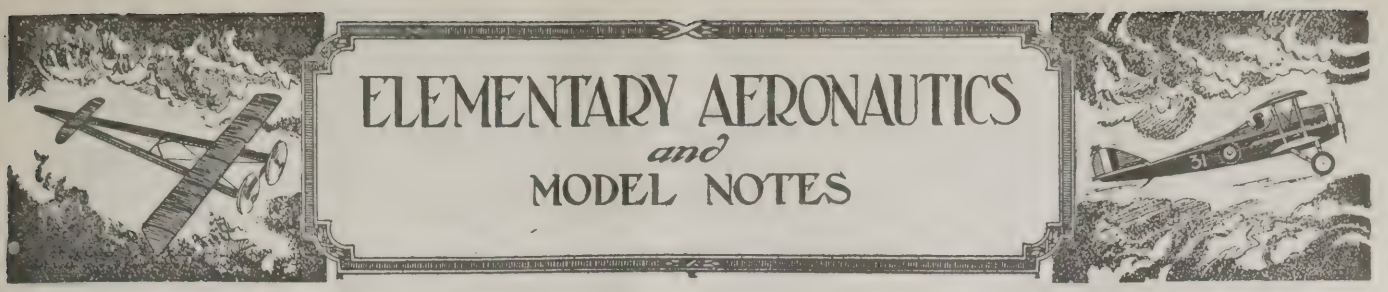
Another "Viking IV" has been ordered by the French Government (or rather the Section Technique), and is the only machine destined to be used for civil purposes that Vickers have in hand. This machine has a neatly arranged cabin for passengers. The three machines mentioned will be tested very soon, and duly delivered.

R. A. F. "R.38" Memorial

The Air Council, in deference to representations which have been made to them, have approved of a fund being opened in the R.A.F. to provide a memorial in the Western Cemetery at Hull over the grave of the officers and men who lost their lives in service on the "R.38."

France to Have a Soaring Competition

Encouraged by the success attained by the Germans in the Rhön Mountains, the French sporting journal *l'Auto* announces that it has decided to organize a soaring and gliding competition in France during 1922. The rules and dates for the competition will be announced shortly.



Aero Congress Purchases Models

TWO models, a scale model of the Curtiss "Jenny," and a K. O. G. "A" type racer, designed and built by C. H. Fastje, have been purchased for photography and advertising work for the International Aero Congress, to be held in Omaha next month.

As Omaha is only 75 miles from Dennison, Iowa, where Mr. Fastje resides, the models were delivered by automobile, so that it was unnecessary to take them apart for shipment.

Mr. Earl W. Porter, president of the Aero Club of Omaha, discussed the subject of an exhibition of models. It is expected that prizes will be awarded for workmanship, etc., and that various awards will be given to builders exhibiting their own models. The compressed-air motored model and the Curtiss triplane scale model, recently described in AERIAL AGE, will be exhibited by Mr. Fastje.

Before delivering the "A" type racing model, it was practically rebuilt and 16-inch propellers were used. The model as it now weighs is a couple of ounces lighter, and consequently its flying qualities are improved. For four or five days the model was flown with interesting results. The cutting down of the weight made it possible to fly the model as far on 75 per cent of the number of revolutions previously required for the same distance.

Woods Used In Aircraft Construction

(Concluded from last week's Issue)

Cottonwood

Common cottonwood is known also as big cottonwood, yellow cottonwood and Carolina poplar. Swamp cottonwood is known also as black cottonwood, river cottonwood and swamp poplar.

These species are low in strength properties, but light, tough, and fairly easy to work. It is used chiefly for ply wood.

Red Gum

This species is also known as satin walnut, sweet gum, and liquid amber. Red gum is also another approved material for aeroplane ply wood and is used considerably for various commercial purposes. It is a promising wood for future use in the aircraft industry.

Mahogany

The principal varieties are Central American, African, and Philippine mahogany, the last species sometimes called Tanguile or Bataan mahogany. Red Lauan is sometimes called Philippine mahogany.

The true mahogany is a most excellent wood for propellers and has been used very extensively for that purpose. Selected pieces of the African variety are as satisfactory as true mahogany, but on account of the wide variation in strength properties between the different species and between different lots of lumber from the same species, together with the difficulty of distinguishing the different species by inspection, African mahogany has not been popular as propeller wood. The Bataan mahogany from the Philippine Islands has also found a limited use for propellers.

American and African mahoganies make excellent ply wood, but will hardly be used on a large scale because of their high cost as compared with native woods which are quite as satisfactory.

Spanish Cedar

Spanish cedar (also called Indian mahogany) is light, durable, easily worked and strong for its weight. It makes excellent ply wood and has been used to quite an extent for the thin planking for flying boats and pontoons or floats.

It is interesting to know that in the United States, more than 99 per cent of the cedar used goes into the cigar-box industry.

General News Notes

A small sport plane is being designed by sailors of the U. S. Naval Air Station at Coco Solo, Canal Zone. This machine, upon which work will soon be started, is to be provided with a three-cylinder, 60 H.P., air-cooled Lawrence engine.

An automobile, driven by an air-propeller, is being built by some mechanics of Hillsboro, Kansas. A 410 H.P. King-Bugatti aeroplane engine is to be installed in the rear of a racer Cadillac chassis.

Since the recent publicity given to the experiments with gliders, now claiming the attention of aeronautical enthusiasts in Germany, several American model fliers are becoming interested in this branch of the sport. Some of our Americans who are familiar with the German language are making a detailed investigation of the German types with a view to building exact reproductions with, it is hoped, improvements which will make the "motorless" plane more popular in the United States.

Scale Models Built by Readers of Aerial Age

An accurate exhibition model of a flying boat has been built by Mr. L. W. Lawrence, of Fairhope, Alabama. This model, which bears a striking resemblance to a modified F5-L flying boat, was built from materials obtained in Mr. Lawrence's own shop.

These are the dimensions:

Span, upper wing	53 inches
Span, lower wing	42 inches
Wing chord	5⅛ inches
Area (with ailerons) upper	260 sq. in.
Area, lower wing	194 sq. in.
Total wing area	454 sq. in.
Stabilizer area	30 sq. in.
Elevator area	19 sq. in.
Rudder area	12 sq. in.
Fin area	14½ sq. in.
Length of hull	22 inches
Width of hull	6½ inches
Depth of hull	3 inches
Gap between wings	5 inches
Draught (light)	¾ inch
Draught (loaded)	⅞ inch
Weight of boat complete	17½ ounces

The covering is with bamboo paper treated with three coats of dope and finished with two coats of Valspar. An 8½-inch diameter propeller is provided for each of the two dummy 12 cylinder Liberty motors.



An F5-L type scale model of 53-inch span made by L. W. Lawrence



Health Hints

Dear Doctor—How can I acquire more pep?—Lazy.

Answer—Wave a red shirt in front of a bull.

Dear Doctor—Would you advise me going to Colorado for my health?—Joe.

Answer—If you left it there, yes, by all means.

Dear Doctor—What's good for sore eyes?—Bill.

Answer—Stand on the corner of Fifth and Broadway for one hour on a windy day.

Dear Doctor—Is a walk on an empty stomach injurious?—Bob.

Answer—It all depends on whose stomach you walk on.

Regardless of how much work a paperhanger has, it always drives him to the wall.

She: "What kind of gardens give you the most satisfaction?"

Sailor: "Beer gardens, my good lady, beer gardens."

Other Times, Other Manners

O youth, beware the fond gazelle,
Else will you presently regret it,
In other days they pined and died,
But now they sue for cash—and get it!

—*American Legion Weekly.*

"Lives of great men oft remind us
We should choose our wives with care,
And departing, leave behind us,
Half our natural growth of hair."

—*Fasces.*

Never Snooked a Snook

"I want to start annulment proceedings against my wife," growled a big, red-faced man as he flung his bulk into a chair in a lawyer's office.

"On what grounds?"

"On the grounds of misrepresentation!" bawled the irritated client. "She insists on calling me Snookums."

—*American Legion Weekly.*

He Was a Deckhand

A sailor who had landed after a long voyage and been paid off, called a taxi, threw his luggage inside and jumped up on top himself.

"Beg pardon," said the astonished driver, "but you should get inside and put your boxes on top."

"Steer the craft, me hearty," chirped the gob. "Passengers always go on deck and the luggage in the hold."

A Blooming Chicken

Little Mary was visiting her grandmother in the country. Walking in the garden, she chanced to see a peacock, a bird she had never seen before. After gazing in silent admiration, she ran quickly into the house and cried out: "Oh, granny, come and see! One of your chickens is in bloom."

—*The Christian Register.*

"Help, help!" screamed the terrified young man who had just fallen off the wharf. "I can't swim!"

"Wot of it?" asked the stevedore mildly, taking his pipe out of his mouth and glancing carelessly over the edge of the wharf. "I can't neither, but I ain't yellin' my head off about it."—*Pathfinder.*

Mose: Dis yar flying business is ah mighty ol' venture.

Rastus: How you make that out, Mose?

Mose: Because I heah that pastor say in church las' Sunday night dat Esau sold his heirship to Jacob.

Home Broo

Pursue a wild bullfrog thirteen miles, carefully gathering the hops. Then add:

10 gallons of pickle brine,
2 quarts of shellac,
1 bar home-made soap,
1 pint sweet spirits of nitre.

Boil mixture three weeks then strain through an I. W. W. sock to prevent mixture from working. Bottle and add one mule to each pint to give it the proper kick.—

—*E. McD.*

At a dinner one day in Pomona,
They served only steaming bologna.
"It looks queer,"
Said a maid, "I do fear
I shall have to remove its kimona."

It is not good for a man to be alone; that's why woman refuses to do so.

Rose: Why is it that professors claim touch to be the most delicate of all the senses?

Mary: Because when you sit on a pin you can't see it; you can't hear it; you can't taste it—but it is there just the same.

Take Ear, Oh Men!

Jane: "What do you think of a man who throws a girl a kiss?"

Babe: "I think he's the laziest man in the world."

Bill: "S'funny, ain't it?"

Buster: "Shoot."

Bill: "Bills are rectangular, yet they come rolling in."

There's a Reason

By Edna McDonald.

Now that women smoke, vote and wear "knickers," it's a wonder they don't want to be more masculine and raise a beard. Here is one reason why they can't. If anyone can think of a better reason, a pickled herring will be the prize.

How wisely Nature, ordering all below,
Forbade a beard on woman's chin to grow;
For how could she be shaved with skill—
Whose tongue will never let her chin be still?

The Newlyweds

Hon and Dearie were married in June and were on their honeymoon.

After many delays, they were all set to go out one evening when Dearie said:

"Just a moment 'til I comb my hair, darling."

"No, Dearie, let Honey comb it!"

The hotel authorities put a two cent stamp on the blotter containing the poor boy's remains and Dearie is still raving and frothing at the mouth in a padded cell.

MORAL: True love never runs smooth after the "hitch" occurs.

He came to her at sunset like a feeble moth to the flaming candle. He hovered about her as her magic ever drew him closer. His heart rose in his bosom as he drew nearer—like nothing but the dusty-winged moth.

Closer, closer—until the wings almost touched the searing flame—the flame that meant death, destruction. But her heart melted and she spared him.

She turned out the light!

Binks—"Jones has a mania for playing the clarinet when he's stewed."

Jinks—"Huh, trying to imitate the 'Pie-eyed Piper' eh?"

"Jack leads a pretty wild life, doesn't he?"

"Yeah, his old man owns a sugar plantation and he just naturally has to raise cane."

He—"Would you care to dance this dance?"

She—"Yes, would you mind asking someone for me?"

Preacher (to returned private)—"Well, Sam, I see you're back from the front."

Sam—"Is dat so, boss? Wal, now, I suah knew I was gettin' thin, but I didn't think I was dat bad."—*Juggler*

29.105
EA
Engineering

UNIVERSITY OF ILLINOIS
OCT 2 4 1921

AERIAL AGE WEEKLY

VOL. 14, No. 7 OCTOBER 24, 1921 10 CENTS A COPY



Airscape of St. Albans Golf Club Photographed for the Fairchild Aerial Camera Corp., by W. L. Hamilton

The Truth About Our Aeroplane Record

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
scriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

Frank F. Fowle, Editor-in-Chief, assisted by over sixty leading specialists. 25 thumb-indexed sections. 2000 pages. 4 by 7. Flexible. Illustrated. Postpaid $7.40 net.

The "Standard" is the most widely-used electrical book in the world. It is quoted everywhere as the final authority on electrical engineering. It has been endorsed by the leading electrical journals here and abroad. It is an encyclopedia of electrical engineering. Its twenty-five thoroughly indexed sections cover every phase of the subject. The book is the work of more than sixty of the world's foremost electrical engineers. It has been called a triumph of engineering cooperation because of its completeness, its reliability, and its get-at-ableness. [McGraw.]

The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¼ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

All orders must be accompanied by check—no books sent on approval

Address: Book Department

AERIAL AGE WEEKLY **280 Madison Avenue, New York**

October 24, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 7

TABLE OF CONTENTS

Discounting Naval Aviation 147
A Serious Naval Problem..... 147
The News of the Week..... 148
The Aircraft Trade Review..... 149
N. A. C. A. Recording Air Speed Meter 151
Information for Pilots Giving the Practical Characteristics of the Land Along Various Air Routes. 153
The Truth About Our Aeroplane Record 155
Naval and Military Aeronautics... 159
Foreign News 160
Elementary Aeronautics and Model Notes 161
Aeronitis 162

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

COX KLEMIN AIRCRAFT CORP.

Consulting, Designing and Constructing Engineers

COLLEGE POINT, L. I.

Telephones Flushing 3682-J
Flushing 1800

FOR IMMEDIATE DELIVERY. CAN BE INSPECTED IN OUR SHOPS

STANDARD-MERCEDES

Brand-new, three place Standard with New Mercedes motor. Motor is rated at 160 h.p. and develops close to 200 h.p. Reports of pilot show perfect balance, great speed and climb. Completely equipped with instruments, and finished in every detail.

Price F. O. B. Factory..... $3500.00

D.H.-6 BENZ

New D.H.-6 with new Benz. The Benz six cylinder motor is rated at 120 h.p. and delivers 150 h.p. The combination makes a real two or three seater, which is in a class by itself as regards performance, general flying qualities and price.

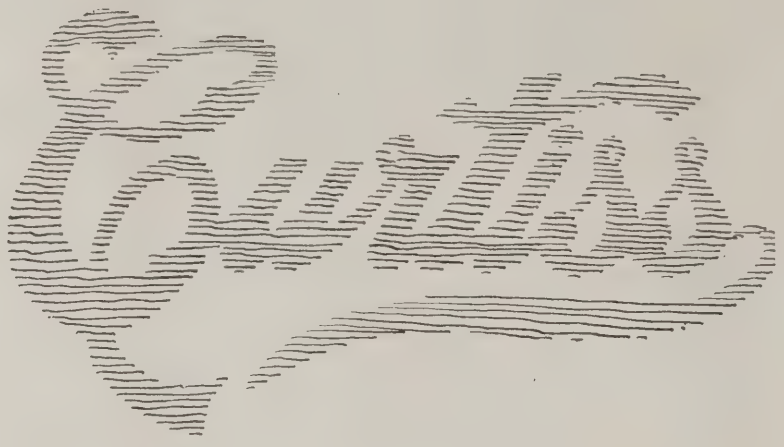
Price F. O. B. Factory..... $2250.00

MOTORS

Mercedes, Benz, and Isotta-Fraschini's at reasonable prices.

AIRCRAFT MATERIALS and accessories.

Write for prices and specifications. ALL inquiries promptly dealt with. Write in and state your requirements.



A Further Reduction

APPROXIMATING 25%

in the price lists of parts

for

Orioles
O X Standards

Jennies
C 6 Standards

is announced

EFFECTIVE SEPTEMBER FIRST

Write for revised price lists.

Motor price lists are not affected in this reduction.

CURTISS
AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., October 24, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, OCTOBER 24, 1921 NO. 7

Discounting Naval Aviation

IT cannot be denied that the Navy Department has resisted, or only half-heartedly advocated, the development of aviation ever since Admiral Fiske first urged its importance in 1916. During the preceding Administration the Secretary of the Navy and the Chief of Operations cut appropriations, discouraged progress, and sent us into the world war with no aviation material and with a devoted little band of only forty-five trained fliers.

Following the war, until very recently, the record of neglect and obstinacy has continued. The Daniels regime, in its staggering demand for twenty additional $40,000,000 capital ships, submitted the naval bill with only a petty little $6,000,000 for aviation. The present naval administration was finally goaded into a tardy advocacy of two aeroplane carriers, but its continued insistence upon the 1916 programme caused Congress to cut from the bill the two weapons most needed by the navy —submarines and air forces.

General Mitchell declared that he could sink battleships with bombs. The late Secretary of the Navy pooh-poohed the General, sarcastically called him "Admiral" Mitchell, endeavored to throttle him, and capped the climax by declaring that he would gladly stand on the bridge of a ship and let Mitchell bomb it!

Well, where would the silly Josephus be to-day? "Admiral" Mitchell proved the soundness of his every claim. The Joint Board was forced to admit that bombs can sink any ship that floats and any ship that can be designed.

Moreover, the bombing of the German ships would have been a farce had it not been for General Mitchell. It appears that the Navy Department, the General Board and the "Principal Dignitaries" in the bureaus were anxious that the ship should not be sunk by bombs. The "rules" of the game appeared to have been drawn to protect the targets. The little naval air contingent had slight opportunity to show what it could do. It was permitted to use only lightweight bombs. The navy planes with 1,000 and 2,000 pound bombs were turned back in compliance with the "rules." And when Mitchell sank the Ostfriesland the cry was raised that he had violated the rules—"disobeyed orders!"

Grant that he did. Nelson disobeyed orders at Copenhagen and won the battle. If Mitchell disobeyed orders he at least taught us something of vital importance to the country. The "rules," the "orders" would have taught us—nothing. Shall we court-martial the General who did something and taught us something? Or shall we court-martial the "orders" which taught us nothing, and which might have prevented us from learning anything?

And the Alabama experiments furnish more evidence of lackadaisical indifference at the War and Navy Departments. These tests would never have taken place but for Mitchell's insistence. And the Navy Department sends a board to witness them composed of a naval constructor and a few young officers of the navy—all excellent officers to be sure. But where were all the admirals and captains of the navy? Could not the Chief of the Bureau of Navigation or the Chief of Operations find one line officer of high rank to witness and report upon tests second only in importance to those of the Ostfriesland—tests that had never been made before by any army or navy as far as we know?—*Editorial in N. Y. Herald*

A Serious Naval Problem

UNLESS higher officials of the Navy Department take steps to prevent it, more than 200 naval aviation reserve officers,, who served during the war, and the service of most of whom is declared vitally needed for the development and upbuilding of the naval flying corps, will be forced out of the navy by the examinations recently held to enable them to enter the line of the navy.

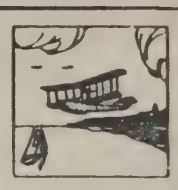
Out of about 400 temporary and reserve aviation officers who took the examination, only about 130 passed, approximately 32 per cent. This means that, unless the Navy Department adopts a more lenient attitude, about 270 temporary and reserve officers will fail to enter the line of the navy, and of this number approximately 200 naval reserve aviation officers will be forced out of the service.

Those who are familiar with the facts in the case assert that the loss of these officers will not only work unfairly and unjustly to them, but will seriously cripple the naval aviation service. Their failure to pass the examination to admit them into the line was not due to lack of practical knowledge or experience in naval aviation, but because they were not able to meet that part of the examination based on technical subjects dealing with naval, rather than aeronautical matters, with which they were unfamiliar and unable to qualify because of a peculiar combination of circumstances. While they were allowed so many months in which to "bone up" on the subjects with which they were unfamiliar, the fleet manoeuvres, various kinds of official flying duty and the bombing tests interfered with the opportunities to study.

Secretary Denby is understood to be looking into the matter, and it is the hope of those who are interested in the future of naval aviation that he will find a way for retaining most of the reservist aviation officers. If the matter stands where it is it will be impossible, it is asserted, for the navy properly to operate the aviation bases it intends to retain under its present plans of economy.



THE NEWS OF THE WEEK



Successful Meet at Curtiss Field

To demonstrate the practical value of the aeroplane as a commercial vehicle of travel and to show the public the results of a year's progress in aeronautical development the Aero Club of America held a flying meet at Curtiss Field, near Mineola, L. I., October 16. More than 5,000 persons attended. After the various contests, in which a dozen planes of both American and foreign manufacture participated, short "hops" were given to as many spectators as could be taken up before it grew too dark. During the afternoon about fifty planes landed and took off from Curtiss Field.

Apart from the newest types of aeroplanes, which, like the automobile, embraced the slow and the fast, the open and the enclosed models, popular interest centred in an efficiency contest for a trophy offered by the Wright Aeronautical Company, makers of the Hispana-Suiza engine. The trophy was put up for the best demonstration of manoeuverability. Five planes were entered in this contest, which started October 14 and ended October 16.

The Loening flying yacht, holder of the world's altitude record with passengers of craft of this type, which on October 14 made six round trips between Port Washington and New London, Conn., made four round trips from the same starting point to Southampton, L. I., on October 16. The time on the New London route was 5 hours and 33 minutes for the six trips. The total cost of carrying twenty-four passengers was $65, which included oil, gas, depreciation and insurance. The railroad fare would amount to $135.40. This was believed to be a new seaplane fuel economy record. Clifford Webster was pilot. Grover Loening, builder of the flying yacht, was one of the passengers. The average time for the trip to Southampton was 42 minutes. Four passengers were carried. All the trips were made on scheduled time.

J. L. Larsen chose a route from Mineola to Miller's Field, New Dorp, S. I., for his all-metal limousine plane. Piloted by John F. Petre, it made six round trips at scheduled three-quarter hour intervals, carrying seven passengers. The average time for negotiating the thirty-two miles was twenty-three minutes. The plane flew at a height of 2,000 feet.

The Fokker Half Moon made its trip on Saturday, flying to Providence, R. I., from Mineola, with six passengers and pilot. The figures showed that it flew the 290-mile trip distance in three hours and fifty-nine minutes at a total cost of $53.90, as against a railroad cost of $105.50. Bert Acosta was pilot.

A Farman sport plane sought to win the trophy on points for general manoeuverability. Lawrence Sperry's plane entered on a similar basis. In the take-off it left the ground in twenty-nine seconds. It climbed 1,500 feet in nine minutes with five passengers aboard.

By way of contrasting the present type of plane with an earlier model, Bert Acosta flew in a Curtiss biplane built in 1911. The pilot in this machine, which looked none too secure, sat in the fore part of the machine and when the plane was in the air he seemed astride a bicycle. The 1911 model averaged eighty miles an hour. The largest and smallest planes in this country, the Remington Burnelli with a wing span of 77 feet and accommodations for thirty-four passengers, and the Mummert Cootie with a 15-foot wing spread, went up together. The Burnelli plane took up fifteen persons at a time. Bert Acosta piloted the Mummert plane, flying the machine in his stocking feet, because, as he explained, he did not care to overweight it.

One of the events which found favor with the crowd was a balloon chase. Small toy balloons filled with hydrogen gas were released from the ground. Aviators sought to shoot them down by knocking their propellers against them. Acosta in the 1911 Curtiss hit three, Richard Depew's Curtiss put two others out of commission, while several other pilots exploded one apiece.

A parachute jumping contest was another thriller. A mark was made on the ground which the jumpers were to attempt to touch. Peter Devlin won first prize when leaping from a height of 1,500 feet; he landed forty-three yards from the mark. F. U. Meeker came second, hitting the ground 150 yards away. He jumped from a height of 1,500 feet.

Benedict Crowell, former Assistant Secretary of War, who recently was elected President of the Aero Club of America, issued the following statement at the conclusion of the meet:

"The flying meet at Curtiss Field today, and those which are shortly to be held in Kansas City and Omaha, mark the real beginning of American air power. They are especially significant in the light of the forthcoming conference in Washington which hopes to relieve a tax-weary world burdened by excessive and unproductive armaments.

"Without minimizing the value of the older arms on land and sea, which we must always have, the flying which is going on throughout the country today offers the greatest hope to the nation of a successful outcome at this conference. We must have protection of the most efficient and economical sort. This is what the air power provides.

"American aviation offers a real contribution to our transportation problem and is ready to assist in the present crisis. As it grows in economic efficiency, it will increase also as that defensive factor which is the cheapest, speediest and the most certain in the time of need."

H. H. Hartney and Augustus Post of the Aero Club of America were in charge of the meet. They said the winner of the efficiency trophy would not be known until the records were checked.

Aerial Service Planned for Duck Hunters

C. F. Redden, president of Aeromarine Airways, Inc., announced that flying boats of his line will make special flights to Great South Bay and to Chesapeake Bay for sportsmen during the duck hunting season. The flying boats will be equipped with everything necessary for the comfort of the sportsmen.

"This service," he said, "is to be inaugurated as an auxiliary in the development of commercial air transportation. We have had a large number of inquiries from wealthy sportsmen who are anxious to obtain a speedier means of transportation to and from the almost inaccessible reaches around Pimlico and Albemarle sounds and Chesapeake Bay. With flying boats it will be possible for them to traverse in minutes distances that it now takes them hours to cover."

The local wild duck season opened October 16, and the first to take advantage of the novel service offered by the Aeromarine Airways, Inc., was Lieutenant Commander J. A. Davis, U. S. N., with a party of three friends.

Quick Washington-New York Flight

WASHINGTON.—Flying at an average speed of 170 miles an hour, Lieutenant Howard K. Ramey, piloting a De Haviland army aeroplane in which Lieutenant Leroy Wolfe was a passenger, made the trip from Washington to New York on October 10 in 79 minutes, setting a new record. It was announced at Bolling Field.

The previous best time for the trip was 86 minutes. The flight was made at an average height of 3,800 feet.

Denby Urges Aircraft Carriers

The Navy Department plans to ask Congress immediately for additional appropriations to build aircraft carriers for the Navy and will go ahead with its building program regardless of the arms conference.

Official announcement to this effect was made October 12 by Secretary Denby to the House Naval Affairs Committee. The department sees that decisions by the conference cannot be anticipated and realizes that the Navy is lacking in certain elements of a well rounded fleet.

The Secretary's statement is an answer to those who expect the conference to "disarm," and shows that the best that can be expected of it for armament is a limitation which will lessen economic burdens and eliminate the danger of competitive building among nations.

The Navy has not changed its belief that the capital ship remains the basic unit of the fleet. Naval officers believe there has been much misconception on the views of the Navy General Board, owing to the debate precipitated over the relative merits of the capital ship and aircraft.

Naval officials guiding the construction program think the bombing tests have demonstrated the increased possibilities of aircraft. No one has been quicker to recognize this than the naval group which retains its faith in the capital ship. It is their belief that all future naval operations will be carried on with a large complement of air craft for bombing and for long distance gunfire.

The Navy is daily developing new possibilities in long range guns and sees the time when navies will fire at each other over the horizon, making aeroplanes necessary for range finding.

Aeroplane construction has not reached the point where the heavier-than-air craft can operate far from their base and carriers are essential to transport them with the fleet. Experiments are being made also to have each warship carry its own complement of aircraft. With the exception of the converted aircraft carrier Langley, the American Navy is not equipped with carriers.

The determination to go ahead with construction has in mind in part the other elemental weakness of the Navy shortage of light fast cruisers. Any limitation of armament at this time would find the American Navy lacking in this important requisite.

Amundsen Plans Aerial Journey to North Pole

Seattle.—Determined to reach the North Pole regardless of risk, Captain Ronald Amundsen, discoverer of the South Pole and conqueror of the Northwest Passage, will resort to the aeroplane, if necessary, writing a new chapter in Polar exploration, it was disclosed when he began negotiations for the purchase of two aeroplanes. He will have the aeroplanes aboard his Arctic exploration ship Maud when he sails out of Seattle harbor next May on his way to the great wastes of the Far North.

News of Captain Amundsen's plan to fly to the North Pole was confirmed by H. H. Hammer, president of the Universal Shipping and Trading Company, who is acting as the explorer's general agent here. Captain Amundsen is a pilot, Mr. Hammer said.

Captain Amundsen has engaged two Norwegian aviators for the next effort to reach the North Pole. One served in the Norwegian army and the other in the navy.

They are to arrive here the first of the new year. The original plan of the Amundsen expedition, which is financed by the Norwegian government, was to drift with the Arctic ice pack to the North Pole. Last fall the Maud damaged her propeller in the ice off Siberia, delaying the expedition one year. She was towed into Behring Sea by the coast guard cutter Bear and then sailed all the way to Seattle under her own canvas. She is now moored in Lake Union here. In the meantime Captain Amundsen is busy preparing for the departure of the expedition next May.

Wants Air Warfare Taken up at Parley

Rome.—Senator Morandi, the boyhood tutor of King Victor Emmanuel, interpellated the Government in the Senate on the course to be followed by the Italian delegation to the Washington conference on limitation of armaments and Far Eastern questions.

He said that since incredible progress had been made in aerial navigation, that question should be put forward at the conference. Signor Morandi suggested discussion on the substitution of aerial forces for capital warships, which he declared, were "carrying the Governments to financial ruin." He said that Japan was extremely vulnerable to attacks from the air because of its wooden houses.

House-Hunting by 'Plane

Paris.—A wealthy American intending to spend the winter in Paris adopted a novel method of finding an apartment during the housing crisis. Hiring an aeroplane, he had the pilot drop 100,000 cards announcing that he was seeking an apartment with nine rooms and two baths, regardless of price. The aviator sprayed the cards over the Avenue Bois de Boulogne, the Etoile, the Champs Elysees and the Rue de Rivoli.

The American is reported to have received 200 replies.

Helium Gas for Airships to Be Tested by the Navy

Washington.—Plans are in progress to make practical use of helium gas in navy airships in the near future. An immediate start is to be made in experimenting with the gas at the naval air station, Hampton Roads, Va., where a non-rigid airship of the C class will be inflated. This experimentation is being conducted in connection with tests in regard to buoyancy, valve control, permeability of airship fabric and methods of handling helium in connection with all types of lighter-than-air craft.

This will be the first airship in the world to be so inflated, and it is expected that important data will be obtained which it is hoped will be of considerable value in future employment of the gas.

This will be in accordance with the provisions laid down by the aeronautical board of the army and navy for the experimentation and development of lighter-than-air craft.

Alula Wing Test

London.—A demonstration was given October 12 at the Northholt aerodrome of an aeroplane fitted with wings of a new design that in the inventor's opinion is likely to revolutionize air flight.

The "Alulu" wing is the invention of a Dutchman, Mr. Holle, who hopes soon to attain a speed of between 200 and 300 miles per hour with it. The wing was described in detail some months ago in AERIAL AGE.

When the pilot came down after a long series of manoeuvres he said he had been traveling at 184 miles an hour, and that his rate of climbing was as high as 2,500 feet a minute. The angle of some of his ascents was sixty degrees.

Aviator's Mother Honored

London.—Mrs. McCudden, mother of the late Major Byford McCudden, V. C., of the Royal Air Force, has been chosen to take to Arlington a national wreath for the grave of the Unknown American Warrior. This selection was made under the auspices of the Pilgrim Fathers' Association from a list of eight mothers bereaved in the war. Over 600 of these mothers had expressed the wish to undertake the duty and the final choice was not easy.

Mrs. McCudden's husband, who was accidentally killed last year, had thirty years' army service. She had three sons killed in the war and also lost her son-in-law and two nephews on active service.

The Kokomo Aero Meet

Forty-three aeroplanes of various types and sizes, and representing practically every state in the central west, took part in the national aviation meet held in Kokomo, Ind., September 22 to 25. When the last contestant brought the wheels of his ship to the ground he ended an aircraft "get-together" that was, in the opinion of every participant, the most successful ever held in this section of the country.

Originally scheduled for three days—Thursday, Friday and Saturday—the interest on the part of the visitors prompted those in charge to continue the meet over Sunday, since, by so doing, the residents of that vicinity who were unable to get to the field during the week would have an opportunity to see the commercial and army fliers in action and examine the various types of planes on exhibition. When approached on the subject of staying over for another day, all pilots immediately consented, as they were anxious to prove to the public the utility of the aeroplane.

Thursday—the first day of the meet—was a busy one at the flying field. Visiting pilots started to arrive early, and by noon there were 18 ships neatly parked "on the line" awaiting the beginning of the various contests to be held in the afternoon. These events consisted of a speed race, formation flying over the city, exhibition and acrobatic flying, altitude tests, "dead stick" landings and two parachute exhibitions. One of these was from an altitude of 3,000 feet by "Laddie," the famous parachute dog, and the other by Master Sergeant Ralph W. Bottriell of Dayton, O. The sergeant was flown to Kokomo for the occasion in a DeHaviland machine, piloted by Lieutenant Van Zandt of McCook Field, the trip of 125 miles being made in an hour and twenty minutes. Before the end of the afternoon hundreds of motor cars parked around the field and on nearby reads, many of which carried license tags of adjoining states. The thousands of spectators that lined the airdrome were kept busier watching the various air events than a boy witnessing a three-ring circus for the first time.

The night program ended with an exhibition by Major Wilbur M. Fagley and Ross Jacobi, who took off in their electrically-lighted aeroplanes and thrilled the spectators by their daring and spectacular flights. Flying for a minute or so with their planes outlined by miniature electric lights, they took great delight in switching them off for a brief period only to flash them on again to reveal their presence a mile or so away from where they were last seen.

Perfect landings were made with the aid of automobile headlights. Among the day's arrivals were E. M. Laird, designer and builder of the Laird Swallow, who, with his pilot, Buck Weaver, flew in from Wichita, Kansas, in 6 hours and 35 minutes; R. W. ("Shorty") Schroeder; Floyd Logan, aeroplane dealer from Cleveland, and George Eikenberry of Bluffton, who flew in with one passenger.

Friday's program was similar to that of the first day, but more interesting because of more ships being in the various events. Among the new arrivals were Lieut. Nelson and Capt. Fleet, who flew SE-5's from McCook field; a Farnum from Dayton, O., flown by Al Johnson and carrying John Rae as passenger, and a Morane parasol monoplane with Pilot Lieut. Haskell and J. Burke, an army photographer.

In the evening the visiting pilots, army officers and prominent Kokomo business men were guests at a banquet given by the Curtiss-Indiana company at the Country club. Pilots from different states were present, as well as newspaper representatives.

Saturday afternoon brought thousands of spectators to the field, and the day's activities were strengthened by the arrival of new machines. These included Capt. R. L. Meredith, flying a Fokker with a 180-horsepower Mercedes engine; Naval Lieutenant J. D. Price and Lieut. Frank B. Tindall in a DH-4, powered with a 300-horsepower Hispano-Suiza engine, and Lieutenant Niedermeyer, who arrived flying upside down in his Fokker monoplane.

No one could have attended the four-day meet without taking back with him a definite impression that the aeroplane was slowly but surely taking its place as a commercial vehicle that will soon be in everyday use between large cities throughout the entire country. It is just such air meets as this one that do much toward convincing the skeptic that aviation is not a "game" but a business.

The idea of the Kokomo meet was conceived by Major Wilbur M. Fagley, secretary of the Curtiss-Indiana company, who was assisted by the chamber of commerce of that city in the carrying out of his plans. Much credit is due to the Boy Scouts who patrolled the landing field constantly and kept it clear for the pilots at all times.

Number of machines participating	43
Number of landings	215
Miles flown during meet (estimated)	2,000
Forced landings	None
Accidents	None

The AIRCRAFT TRADE REVIEW

Curtiss Eastern Takes Over Atlantic City Station

The Curtiss Eastern Airplane Corp., distributors for Curtiss aeroplanes and motors for the southern part of New Jersey and the States of Pennsylvania, Maryland and Delaware, have taken over the Curtiss Flying Station at the Inlet in Atlantic City, N. J. This station will be run under the direct management of the Curtiss Eastern Airplane Corp., and will be kept open all year round for passenger carrying, aerial photography and sports purposes. They will also keep a large stock of spare parts on hand and will be able to handle any work such as repairs and overhauling that will be necessary.

Aeromarine Airways

Commercial aviation in this country is an actuality. Aero-marines have flown thousands of miles during the past two years; have carried thousands of passengers without accident and the Aeromarine Airways at the present time are operating the largest type of aeroplane or flying boat in existence.

The flying boats operated in this service are more luxuriously equipped; more practically fitted out and in no way inferior to the best air lines in Europe. The attached reprint of an editorial in the Evening Mail indicates that American aviation is being given credit which is justly due it.

The Aeromarine Airways will continue this winter a service between Key West and Havana with five ten-passenger flying boats of which the Santa Maria now in New Orleans on its way to Vera Cruz is an example. This one particular route reduces the time of travel between Key West and Havana from seven hours (by boat) to seventy-five (75) minutes; a saving of time and inconvenience which last winter was greatly appreciated by the traveling public as indicated by the number of passengers carried without accident.

Coffin Addresses Detroit S. A. E.

Detroit.—The Detroit section of the S. A. E. was urged by Howard E. Coffin at the first fall meeting to take early steps toward recommending to Congress the necessity for immediate action on legislation establishing control of the air. Enlistment of private capital in development of commercial air service, he said, cannot be successfully negotiated until such legislation is enacted.

Coffin commended the bill introduced by Senator Wadsworth of New York as satisfactory from an emergency standpoint, while awaiting the formal report of the American Bar Association on the status of air control. To-day, he said, "the only law effective in this country affecting aviation, is the well known law established by Mr. Newton several hundred years ago."

He criticized the laxity which to-day permits anyone to fly any sort of plane, comparing this with the care exercised in the supervision of elevators in buildings. His talk preceded a showing of the official Army and Navy motion pictures portraying the sinking of the German warships by Army and Navy air craft.

Dr. H. C. Dickinson of the Bureau of Standards, Washington, spoke on the activities of the department in automotive research and asked for the co-operation of the private research departments of the factories in reaching conclusions. He said much of the study is of general character and should be accessible for the benefit of the entire industry.

Canadian Registration

The Underwriters' Laboratories advise that the air board of Canada has recognized the Aircraft Register of the Underwriters' Laboratories and that until further notice it will not be necessary for aircraft registered by Underwriters' Laboratories and seeking permission to fly into Canada to have the letter "C" as the first letter in its registration marking.

Applications for aircraft registration and pilot's register can be made to the Underwriters' Laboratories, 207 East Ohio Street, Chicago, Ill.

Seaplane Landing Stations in New York

The commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that landing for seaplanes can be found at the following places:

Gardiners Bay, Long Island, in depth of about 6 fathoms, sand and mud bottom, with good beaching facilities; rise and fall of tide 2.5 feet. There are no obstructions. *Landmark.*—Plum Island Lighthouse. *Supplies* of all kinds can be had at Three Mile Harbor.

Fort Pond Bay, Long Island, in depths of 7 to 8 fathoms, soft mud bottom, with good beaching facilities; rise and fall of tide 3 feet. The landing is exposed to north and northwest winds. *Supplies.*—Gasoline, oil, and fresh water can be obtained at Montauk.

Greenport, Long Island, in depths 2 to 6 fathoms, hard bottom, with good beaching facilities; rise and fall of tide 2.4 feet. *Supplies* and repair shops can be had at Greenport. *Landmarks.*—Pier and two large gasoline tanks; best beach to left of tanks and pier. Greenport is an important town and the terminus of a branch of the Long Island Railroad. There are well-equipped shipyards and machine shops. Depth at the wharves ranges from 7 to 19 feet.

Oyster Bay, Long Island, in depths of 7 to 45 feet, mud bottom, with good beaching facilities; rise and fall of tide 7.3 feet. *Supplies* and repair shops at Oyster Bay. *Landmark.*—Village and Eaton Neck Lighthouse. Oyster Bay is a village with railroad communication on the southern shore of Oyster Bay Harbor. All kinds of stores can be had. Rockaway to Oyster Bay 27 miles 41°.

Albany.—Seaplanes can land at Albany in depth of 11 feet at low water, mud bottom; rise and fall of tide 2.9 feet. Landings may be made above and below Albany; beaching facilities only fair. *Supplies* of all kinds are available. Ships should take off south of Albany; taxi to plenty of water. Albany is on the west bank of the river 125 miles from the Battery, and 24 miles from Hudson, a small village below Albany.

New Rochelle.—Seaplanes can land at New Rochelle in depth of 10 feet, mud and gravel, with beaching facilities on the bathing beach. *Obstructions.*—Numerous small craft anchored. *Landmarks.*—Two flagpoles, two chimneys, and white church steeple; lighthouse. *Supplies* of all kinds can be procured. This is a good anchorage in all kinds of weather.

East Quogue, Long Island.—Seaplanes can land at East Quogue in shallow water with poor beaching facilities (cannot approach within 100 feet of beach); bottom not good. *Obstructions.*—A few pier stakes and small sailing vessels. *Landmarks.*—Town of East Quogue, East Quogue Hotel, Coast Guard stations 73 and 74, Shinnecock Lighthouse. *Supplies* and repairs ½ mile.

Clifton, Rosebank, Stapleton, Tompkinsville, St. George.—Seaplanes can land off the above villages on Staten Island in depths of 22 to 75 feet, soft mud bottom, with good beaching facilities; rise and fall of tide 4.5 feet. *Obstructions.*—Steamers and sailing vessels will be at anchor but there will be lots of room for landing and take-off. *Landmarks.*—Stapleton Pier; Fort Wadsworth Lighthouse, red brick, 2,000 yards below Rosebank. *Supplies* of all kinds may be obtained. Coming up the Narrows on the left hand is a red brick lighthouse (Fort Wadsworth); 2,000 yards farther up is town of Rosebank; 1,100 yards, Clifton; 1,200 yards, Stapleton; 1,200 yards, Tompkinsville; 800 yards, St. George.

Providence Seaplane Landing

A landing for seaplanes can be found at Providence, R. I., in depths of 10 and 30 feet, mud bottom, with good beaching facilities; rise and fall of tide 4.6 feet.

Facilities and supplies of all kinds are available. From Oyster Bay to Providence is about 126 miles; course, Oyster Bay to Brenton Reef Light Vessel 72°; Brenton Reef Light Vessel to Providence 356°.

New Jersey Landings for Seaplanes

The commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that seaplanes can land at the following places:

Keyport.—Seaplanes can find a landing at Keyport, on Raritan Bay, in from 3 to 4 feet at mean low water, gravel and mud bottom; rise and fall of tide 5 feet. There is no beach. *Landmarks.*—Aeromarine factory. *Supplies* at Aeromarine factory. Storm warnings are displayed at Keyport. In taking-off taxi beyond bar.

Pleasure Bay, Long Branch.—At Pleasure Bay good landing for small planes may be found, depth of water 10 feet in channel; rise and fall of tide 1½ feet; bottom mud. There are no beaching facilities. *Landmarks.*—Long Branch Steamship Co.'s building with red roof, Coast Guard Station 101. *Supplies* can be obtained. There is room for take-off of Small planes only.

N.A.C.A. RECORDING AIR SPEED METER

By F. H. NORTON
Langley Memorial Aeronautical Laboratory

Summary

A NEW type of recording air speed meter is described which was designed by the technical staff of the National Advisory Committee for Aeronautics. The instrument consists essentially of a tight metal diaphragm of high natural period which is acted upon by the pressure difference of a pilot-static head. The resulting deflection of this diaphragm is recorded optically on a moving film. A number of records taken by the instrument are shown.

Introduction

Air speed in flight has been recorded almost exclusively in France and in this country by the Toussaint-Lepère air speed meter which consists of a recording pen operated by a spring loaded bellows. For very accurate work this instrument has a considerable amount of friction and its natural frequency is so low that it can not be used to record rapid changes in air speed, such as bumps in flight or pulsations in the wind tunnel. The British have constructed a successful recording air speed meter in combination with their Mark II accelerometer, which is of a higher frequency and with less friction than the Toussaint-Lepère instrument.

The N.A.C.A. air speed meter (Fig. 3) was designed with the idea of producing an instrument for recording the absolute air speed in flight with great accuracy and at the same time to have such a high natural frequency that it could be used to study the structure of rapidly changing air flow. As this instrument is of general usefulness in recording pressure difference it was thought that a complete description would be of interest.

Diaphragm Capsule

The pressure difference to be measured is transmitted to either side of a steel diaphragm which is rigidly clamped at the edges between the halves of a circular capsule. As an unstretched diaphragm—due to a trace of concavity which cannot be removed—has two points of equilibrium at zero pressure, it was found necessary to warm the diaphragm before clamping in order that it might be normally under a slight tension. It is also essential that the material of the capsule and the diaphragm have the same coefficient of expansion, otherwise the sensitivity will change with the temperature. This capsule and diaphragm is shown in Figs. 1 and 2.

A hardened steel screw passes through the center of the diaphragm and rests against the polished back of the mirror staff. This staff is mounted in a highly polished conical steel socket and is held against the diaphragm screw by a light hair spring. A plane silvered mirror 4 mm. square and .2 mm. in thickness is cemented to the staff. The deflections of the diaphragm are thus converted into a rotary motion of the mirror with very slight friction. The natural frequency of the diaphragm and mirror is about the same as that of a telephone diaphragm—2,000 vibrations per second. This frequency could be made even higher than this if it were desired to use the instrument for studying high pitch sound waves.

Optical System

The lamp consists of a special 3.8 volt bulb made especially for this work by the General Electric Company to give a true line source. The light from this lamp passes through a lens to the mirror from which it is reflected back through the same lens to the film as described more in detail in N.A.C.A. Technical Note No. 22. In this instrument the lens was a simple one but better results would be obtained by using a corrected photographic objective.

The Film Drum

The film is contained in interchangeable daylight loading drums revolving once in two minutes, a detailed description of which is given in N.A.C.A. Technical Note No. 22.

The Driving Motor

The film is moved by an electric motor connected to the drum by a worm drive. This motor was developed, after a considerable amount of experimental work, as the most satisfactory means of driving a drum at a relatively high speed. This motor is of the direct current, series type and is held at constant speed by means of a governor as shown in Fig. 4. This governor will hold the speed to within 2% of constant for considerable changes in voltage and load. The motor runs on 8 volts, normally taking 1.6 amperes and will reach its normal speed in less than one-half second after closing the switch, with a starting current of 4½ amperes.

(*Concluded on page* 154)

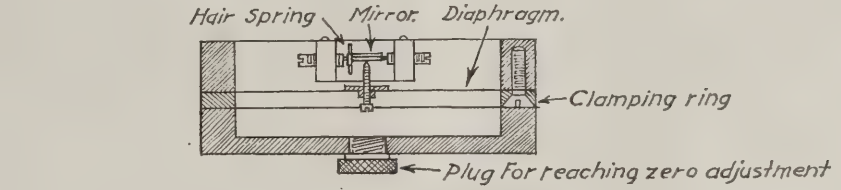


Fig. 2. Section of capsule.

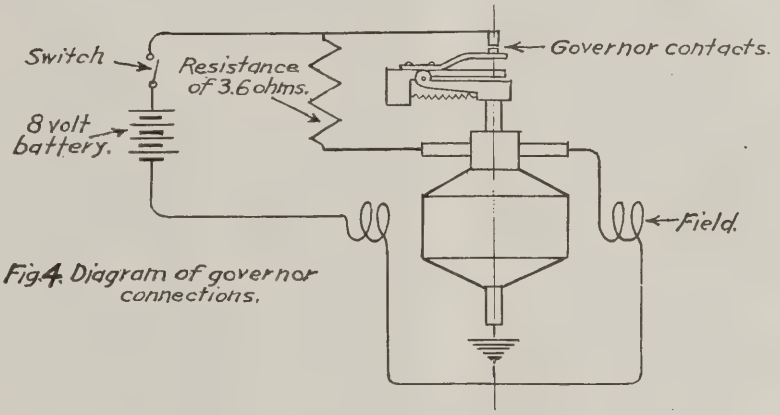


Fig. 4. Diagram of governor connections.

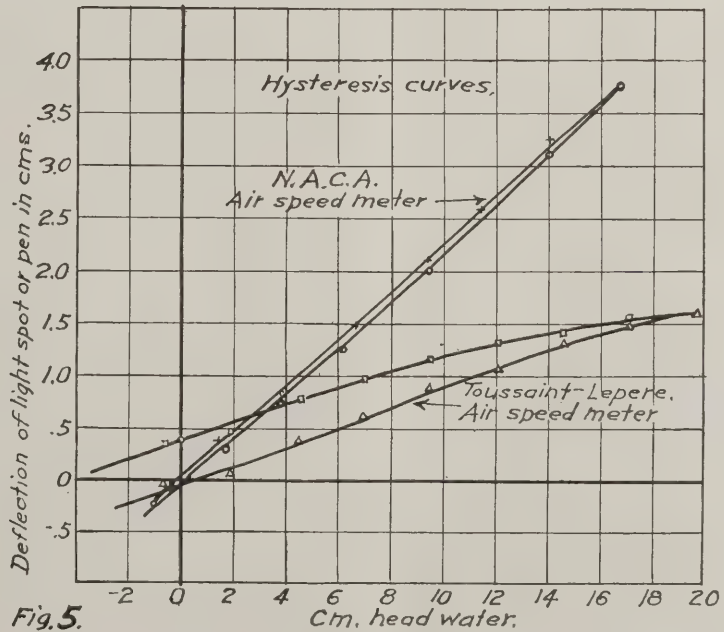


Fig. 5.

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

Mississippi

TUPELO, towards MEMPHIS, Tenn., mostly level, considerable timber, small streaks of red clay hills, landing fields few nearing MEMPHIS. Quite a bit of stump land.

TUPELO, towards MERIDIAN. Tupelo, air good, some timber, irrigation, but several safe fields. On way to OKOLONA, must cross small rough strip, mostly level, some timber, hilly country south and north.

OKOLONA to WEST POINT, country is very good for flying, north are red clay hills, south timber, lots of it, after thirty miles south. WEST POINT to ARTESIA, strips of timber, some emergceny fields 3,000′ altitude safe. ARTESIA to MACON, strips of timber but several open fields. MACON to MERIDIAN, country becomes more timbered, slightly rough. One place altitude 6,000′ needed to play safe. Field MERIDIAN only fair, air good all this section.

WEST POINT to ABERDEEN, mostly open, timber south of ABERDEEN, hilly east. WEST POINT to JACKSON, via STARKVILLE. To STARKVILLE, timber strips, becomes slightly hilly, then red clay hills, then towards JACKSON considerable timber, few landing places. Air good all the way.

WEST POINT to COLUMBUS. Timber strips, fairly level, safe altitude 3,000 feet. No place to land directly COLUMBUS, timber. COLUMBUS to MONTGOMERY, Ala., direct, only one trip made this route, miles and miles with no landing place, all timber and water (small rivers) from TOMBIGBEE, etc. COLUMBUS to ARTESIA, small timber strips, level, safe 2,000′. COLUMBUS to MACON, same. WEST POINT to MONTGOMERY, via DEMOPOLIS. Only practical route, West Point to Artesia, approximate to Macon, thence out southwest to TOMBIGBEE RIVER, over inland town of GAINSVILLE, Miss. This strip is lined with cotton fields, patches of timber, and is very good for emergency landing. Spring of year, danger along Tombigbee of mud and water in landing, south of T. B. miles of timber. GAINSVILLE is built in small hilly red clay section, surrounding north level. Southeast timber. Going towards DEMOPOLIS, yon now begin to enter more sparsely settled country, and more timber, still level. Safe altitude 9,000′ required in some places. Near DEMOPOLIS, breaks up again, as less timber, safe altitude 2,000′. (See Alabama).

Mississippi is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

Central and Northern Mississippi are good, but the western part is bad.

Lots of cotton along the river south of MEMPHIS in delta country—a few good fields here, but a line of hills runs from VICKSBURG, N. E. to GRENADA, then north, and all country south and east of these hills is no place for a ship—like western Tenn., a forced landing usually means a crack up.

A little good stretch from YAZOO CITY to JACKSON, but east of Jackson, broken timber.

Missouri

KANSAS CITY and vicinity, very wooded around here and generally very bad for pilots to fly over. The landing fields here are very small and rough and there are very few of them.

KANSAS CITY to LINCOLN, Nebr., alt. about 4,000, better landings after passing Nebraska line; trees, farms, some sand hills, several pastures, but some rocky.

Northern half of Missouri is all good land to fly over. A great part of it is practically level to slightly rolling.

Extreme western part near Kansas line is good.

The territory in Missouri shows landing fields frequently, and very fertile for the aviation industry. The bad portions of Missouri lie in the Ozark Mountains, and in the south central and southwestern parts of the state. Aside from this, Missouri is very flat, and the hazards are reduced to a minimum.

Central portion running from ST. LOUIS and KANSAS CITY is rolling and hilly for the most part, but a forced landing could be made all right. The territory around Kansas City is very hilly.

Northern Missouri is good, but southern Missouri is very bad, hills and trees.

From CHICAGO to ST. LOUIS the ground is very smooth, ideal as regards flying, only scattered groves, but with the Mississippi Valley soft during wet seasons. This country is subject to heavy rain storms with low fog and clouds at times, but only rarely impassable.

Leaving Forest Park Highlands, ST. LOUIS, one can follow the Frisco tracks to SPRINGFIELD, Mo. There are good fields all the way and gasoline and oil can be obtained. There is a field in SPRINGFIELD, but no hangars. Leaving Springfield, follow the Frisco R. R. tracks to MONETT, 48 miles. There is a small aeroplane factory here and hangars 1½ miles N. E. of town, where one can get parts, gasoline and oil. Leaving Monett follow the Frisco tracks due west to TULSA, Okla., 128 miles. Good landing fields all the way, mostly in 260 acre tracts. Gasoline and oil can be gotten at any town on the route.

Montana

The shortest pass into Montana is between COEUR-d-ALENE and the MISSOULA VALLEY at ST. REGIS and on the stretch there is no place where a forced landing could be made safely. East of MISSOULA the country is rough because of the main range of the Rockies between MISSOULA and HELENA, Mont.

Montana is broken by mountains and bad lands but due to the fact of some very careful flying in that state during the past year, there have been very few accidents, as one plane has flown for two years in that state with a very successful record, and another one in the northern part of the state has done exactly the same thing.

Altitude affects flying here—many landing fields. Maps show altitude and mountainous region. Always very windy, altitude flying different than ordinary flying. J.N.-4 with ceiling of 8,000′ will hardly get off ground at 4,000′ or take double run, also one cannot climb more than, for example, 800′ as bumps settle one, whereas if one started at sea level, he would be out of the way of bumps at 4,000′ and could go on up.

A J.N-4 was flown successfully at an altitude of 5,000′ and at BUTTE, by rigging it different, experienced flyers took off and flew J.N. at much higher altitude. Not so much effect on high powered planes. 3,500 ft., is good limit for J.N.

Nebraska

OGALLALA is situated on the very edge of the sand hills. There is a very level strip from here which continues east to the Missouri River and west to the Rockies, and in places in this section offers a fairly good landing field for a pilot. During certain seasons of the year certain pieces of ground cannot be landed on, on account of vegetation. South for 30 miles the country is level, then for 20 miles sand hills, then again it is level almost as far as Oklahoma line. North of here for 200 miles the country is sand hills, not always bad hills, but merely rolling country, where a forced landing could be made by a careful and experienced pilot. No swamp country in the state to talk of. However, northeast and southeast portions of the state are extremely rolling and would present some difficulty to a pilot not following carefully the level lines of the country. Central part of state is pretty good all the way through.

LINCOLN to OMAHA, only fair, some rocky country. LINCOLN to FREMONT, farms, some trees, fairly level. FREMONT to NEWMANS GROVE, same. NEWMANS GROVE to ALBION, quite a bit of timber, farms, more rolling. Field at OMAHA back of city.

Albion to Columbus, Neb., same.

Lincoln to Aurora, same.

Aurora to Broken Bow, more broken, hillier.

Broken Bow to Ansley, rougher, some sand hills.

Ansley to Ellsworth, sand hills, several long valleys intervening.

Ellsworth to Crawford via Alliance, first part choppy.

Alliance level, last part rolling, Crawford farms, and some rocks.

The entire route CHICAGO-OMAHA is perfect for forced landings. Landmarks are good. The air mail has a fine field at IOWA CITY, Ia. There is also a fine landing field on the north side of DES MOINES. The country from ATLANTIC to OMAHA is a bit rough, but from a reasonable altitude a landing could be picked without trouble. That is, the regular mail route, but one could also follow the Burlington R.R. Chicago-Omaha. As far as the Mississippi River the country is perfect for landing, but from there until the Des Moines River is reached at OTTUMWA, Ia., the country is rather bad, but with plenty of altitude a safe landing would be possible. From OTTUMWA the rest of the route is perfect.

From LINCOLN, Nebr., to ATLANTIC, Ia., one can land at any time from 1,500 feet.

From CHICAGO - OMAHA over IOWA CITY the ground is very level with the exception of some very short

distances in the vicinity of the Mississippi and Missouri Rivers. This country is subject to heavy rain storms with low fog and occasionally is impassable during the rainy seasons; it is also subject to blinding snow storms and very cold weather in winter, but rarely impassable from these.

New Hampshire

MANCHESTER, outskirts of city good.

From KEENE, N. H., to GREENFIELD, Mass., and RUTLAND, Vt., cross-country flying is very good and offers lots of chances to land if a pilot keps a safe altitude.

From GREENFIELD, Mass., to the Connecticut River as far as CHARLESTOWN, N. H., there are any number of excellent fields to drop into that were probably once a part of the river bed. For a distance of perhaps three or five miles on either side of the river there are good places to land in. On the way to PETERBOROUGH, N. H., from GREENFIELD, Mass., there are a few poor stretches about ten miles from MT. MONADNOCK, both on the GREENFIELD side and the PETERBOROUGH side. In the general direction of KEENE (from Greenfield) there are good fields. Keene itself is a good place to fly over because all the outskirts of the city are flat lands, which once formed a large lake bed.

From OLD ORCHARD BEACH, Me., to MANCHESTER, N. H., very good. Fields at MANCHESTER not very good. Thence to WORCESTER, Mass., very good. Excellent field there.

New Jersey

In the vicinity of TRENTON there are no particularly dangerous spots and a cross-country pilot would not have a great deal of difficulty in finding a place to make a landing.

Between NEW YORK and ATLANTIC CITY, starting from BELMONT PARK, L. I., country good all over Long Island. Best course to follow coast line to ATLANTIC CITY. This affords fairly good chance for forced landing.

ATLANTIC CITY via PHILADELPHIA to LANCASTER, Pa., fairly good country, good field at point near PHILADELPHIA. Country affords open fields and farm lands en route, and lots of good fields near LANCASTER. One field fairly good right in the city, F. & M. College Grounds.

NEW YORK CITY to PATERSON, N. J., some few good chances, but rather poor on the whole.

From PORT RICHMOND, S. I., to PRINCETON, N. J., fairly good, good field on canal about four miles beyond PRINCETON.

New Mexico

TEXICO to CLOVIS, level. CLOVIS to PORTALES, same, small sand hills on northeast, larger on south. ELIDA, or west from PORTALES, level to small sand dunes, rolling. ELIDA to ROSWELL, rolling to rough half way crossing Brazos River, more trees, then leveler and some irrigation. East of ROSWELL, rolling. West of ROSWELL, level ten miles, then foot hills, then mountains, from there to CAPITAN, mountains, altitude 5,000′ not safe. CAPITAN to CLOUDCRAFT, altitude 16,000 feet not safe, mountains. CAPITAN to CARRIZOZO, mountains and foot hills, rolling Carrizozo. CARRIZOZO to TUCUMCARI, same. CARRIZOZO to EL PASO, sand dunes, rolling to rough.

TEXICO, N. M., to CLAYTON, N. M., same as EL PASO, only gets level about Union County line, high altitude, air light. CLAYTON to TEXLINE, Tex., level. CLAYTON to DES MOINES, mountains 80 miles out from Clayton, rough, foot hills and pass. DES MOINES to TRINIDAD, rough, safe altitude about 5,000′ above ground.

The eastern half of this state is ideal flying country, practically one large landing field—rolling prairie, the greater part of it never having been broken, and the fences are few and far between, whereas the western half is mountainous and hazardous.

New York

Air route from NEW YORK to NORFOLK, Va., passing through TRENTON, PHILADELPHIA, WILMINGTON, BALTIMORE and WASHINGTON, there is good flying country, many large open fields.

ALBANY, country around here is fair.

LONG ISLAND is excellent country for flying. If one wishes to fly to WESTERLY, R. I., from GARDEN CITY he has a good route to go over. Crossing the Sound is absolutely safe at an altitude of 6,000′ to 7,000′ if the chain of small islands is followed.

NEW YORK to WASHINGTON, D. C., a good route to follow is: leaving MINEOLA, head toward SOUTH BROOKLYN, fly 3,500′ across to STATEN ISLAND, keep off shore to PERTH AMBOY. It is not necessary to trust the engine for about two minutes between the lower end of STATEN ISLAND and PERTH AMBOY. Pick up freight tracks, will bring you to main line P. R.R. "4 tracks," follow same to bridge across Delaware above PHILADELPHIA. This is the second crossing of the Delaware, the first is TRENTON. There are good fields all the way. At the bridge the pilot may skirt PHILADELPHIA, either to the right or left; if the left, he can fly down the river, having plenty of altitude. If taking the right, follow SCHUYLKILL to PARKSIDE AVENUE, PHILADELPHIA, then head for DARBY CREEK on right, thereby cuting off several miles. After passing PHILADELPHIA the tracks can be picked up again. Skirt CHESTER and WILMINGTON. At WILMINGTON, river curves, so follow tracks through ELKTON, Principo, Perryville, Havre de Grace to Aberdeen, where there is an excellent landing field.

There are two favorite routes for flying across the northern part of New York State. One is through SYRACUSE, ROCHESTER and BATAVIA to BUFFALO, the other through OSWEGO and down the lake shore.

From OSWEGO to ROCHESTER on the lake route beginning at OSWEGO, the country is rolling with the hills flattening out as one goes westward. Also the emergency landing fields are more numerous. Beginning at RED CREEK the land becomes more or less level and not so stony, larger fields are more common and it is generally better for flying. There is a good landing field at WOLCOTT, at NORTH ROSE and one at SODUS POINT. The country from SODUS TO ROCHESTER is also good.

The flying country from SYRACUSE to BUFFALO is very good, with the exception of the Montezuma Marshes, which are not very wide, but long. A safe altitude of 3,000′ should be maintained in flying over these. Fields along this whole route are large and level, and make for safe flying. Safe forced landings can be made at LYONS and PALMYRA.

Trip to HAMMONDSPORT, along the west side of SENECA LAKE, beginning from NORTH ROSE to GENEVA is very fine flying country, but after GENEVA is passed the hills begin and the landing fields are not so numerous, more woods are seen and the country is not nearly as good for flying. One may expect quite a bumpy passage over GENEVA if the wind happens to be in the south, as it gets a clean sweep the whole length of LAKE SENECA.

The western part of New York State is good flying country.

New York State, west of BINGHAMTON and about 75 to 100 miles north of the Pennsylvania border, hills and mountains are very numerous.

On the mail route NEW YORK-CLEVELAND there are few places a pilot could not make a forced landing without damage to his ship, although it is not impossible.

The country in the immediate vicinity of OGDENSBURG, N. Y., is, without question, excellent for cross-country flying and at a height of 3,000′ and with reasonable headwork on the part of the pilot should bring a plane to a safe landing without the slightest difficulty. The route from this city to WATERTOWN would also fall under this same category.

In regard to seaplane route from NEW YORK CITY to OGDENSBURG. The Hudson from NEW YORK to TROY is perfectly O.K. for any flying boat. Above Troy the river is narrow with frequent swift water spots and dams, as well as being crossed in numerous places with high tension wires strung at a considerable height above the ground.

The route from TROY to LAKE GEORGE requires two jumps over land of approximately five miles in length from GLENS FALLS to LAKE GEORGE. From then on the route follows the length of LAKE GEORGE with about a mile of land to be covered over TICONDEROGA to LAKE CHAMPLAIN, and thence along the length of this lake down the RICHELIEU and ST. LAWRENCE RIVERS. Follow the RICHELIEU to within a short distance of its junction with the ST. LAWRENCE, but a great part of this trip could be cut off by swinging over across a ten-mile strip over land to Montreal, providing the pilot is willing to maintain sufficient altitude to do it in safety. From MONTREAL to OGDENSBURG there are several stretches of rapids to be covered, but three thousand feet is sufficiently high altitude to clear them safely.

There is a field in TROY suitable for small planes such as the Curtiss J.N.-4 type and cruising around in this vicinity and places within a radius of 60 miles from the vicinity of this city; although there are no ready-made fields, there is always in sight a suitable place for a forced landing.

Between NEW YORK and ATLANTIC CITY, starting from BELMONT PARK, L. I., country good all over Long Island. Best course to follow coast line to ATLANTIC CITY. This affords fairly good chance for forced landing.

NEW YORK CITY, starting from ROOSEVELT FIELD, L. I., rather poor in event of forced landings, growing worse around vicinity of Delaware Water Gap and bad approaching SCRANTON, Pa. Heading toward ELMIRA, N. Y., rather better than before but still far from good, although there are fields for forced landings at WYALUSING and TONAWANDA. Fairly good country

near ELMIRA. Lots of good fields a few miles west. Thence to OLEAN, rather poorer country, not so many fields.

NEW YORK CITY to PATERSON, N. J., some few good chances, but rather poor on the whole.

BUFFALO, N. Y. to ERIE, Pa., very good all along LAKE ERIE and good fields at ERIE.

ROOSEVELT FIELD to DANBURY, Conn., across Long Island, good. Across the bay to NORWALK, CONN., and thence to DANBURY, rather poor chance. Vicinity of DANBURY, rather bad and lots of hills.

ROOSEVELT FIELD to PRINCETON, N, J., fairly good. Good field on canal about 4 miles beyond PRINCETON.

The route NEW YORK-BALTIMORE-LANGLEY FIELD, Va. There is not much to choose in crossing NEW YORK HARBOR from LONG ISLAND to JERSEY—the only place to land is HUDSON COUNTY PARK in JERSEY CITY, a grass plot about 900′ long in the center. Following the Central and Pennsylvania R.R. tracks from JERSEY CITY through PHILADELPHIA, WILMINGTON, BALTIMORE to WASHINGTON. There are no landing fields until one gets past ELIZABETH and RAHWAY. From there on to TRENTON are flatlands with many good emergency fields. From TRENTON to PHILADELPHIA and for a radius of about twenty-five miles of this line each way, emergency fields are plentiful. This route is quite safe. PHILADELPHIA to WILMINGTON, along the river, is not so good; it is best to keep several miles inland, where there are good fields. The vicinity of WILMINGTON is good. From WILMINGTON to BALTIMORE is fair, fields are not as numerous as above, but are to be found within gliding distance of a 4,000′ altitude. Baltimore, the city is poor, and for several miles around it the landing field designated as such has not more than a 700-foot run, with obstacles and water on all sides. From BALTIMORE to WASHINGTON, same as from WILMINGTON to BALTIMORE. WASHINGTON to LANGLEY FIELD is a poor route at best. For a short distance out of WASHINGTON there are a few fair-sized fields which could be used, but they are very few and far between on the remainder of the trip. It is best to keep as far inland as possible, as the terrain is all cut up by cracks and rivers near the Chesapeake shore, and is very marshy and swampy.

LONG ISLAND, 3,000′ to 4,000′ will allow one to fly from central Long Island to Staten Island without danger. Fields in race tracks at Belmont (between Belmont and speedway) Speedway, vacant lots back of Coney Island, Newdorp. Some marshes near Jamaica Bay will allow a landing without much more than a nose over.

New York, good fields a short distance east of NIAGARA FALLS and BUFFALO, and generally in ERIE COUNTY, CHAUTAUQUA COUNTY has lots of its flat fields in grapes, but some good fields. East of these two counties, very hilly.

(*Concluded from page* 151)

Precision of the Instrument

The width of the line traced by this instrument is rather great, 0.010 of an inch, due to the poor quality of the lens. If readings are taken on one edge of the line the sharpness is sufficient to read within 1/1000 of an inch, which will give a precision of 1% when the deflection is only 1/10 of an inch.

In order to determine the hysteresis of this instrument its readings were compared with those of a water column when the pressure was increased and decreased. The difference between ascending and descending curves was nowhere greater than 2% of the maximum reading, and this would undoubtedly be greatly reduced under the condition of vibration which exists on the aeroplane. For the sake of comparison a similar run was made on a Toussaint-Lepère air speed meter with the pen resting on the paper in a normal manner. In this case the corresponding hysteresis error was 26% of its maximum reading. The two sets of curves are plotted in Fig. 5.

Several records are shown (Fig. 6) which were taken on a JN4H aeroplane in flight and it will be noted that even the high period bumps are recorded. In Fig. 7 are shown several records taken by speaking into the back of the capsule with the same diaphragm setting but with the drum revolving at a much higher speed. It will be seen that the sound waves are recorded very sharply even though the instrument was not especially lightened for this type of work.

Uses for this Type of Instrument

This instrument has been used successfully for recording the air speed in flight and for studying the flow in the wind tunnel, but by putting in other thicknesses of diaphragm it will be possible to use it for studying a large number of aeronautic and automotive problems. For example it could be used to study the pulsations of flow in an intake or exhaust manifold or the character of the sound emitted by various types of mufflers or the sound waves from a revolving propeller. For the latter uses this instrument has the advantage over a number of laboratory instruments designed for recording sound waves, in that it is portable and can be used under conditions of considerable vibration without having its readings affected.

Municipal Flying Field at Honolulu

There is a possibility that Honolulu may have a municipal flying field in the near future if arrangements can be effected whereby Honolulu Park may be extended to embrace an area 600 feet long and about 200 feet wide. Major-General Wm. P. Summerall, Department Commander, who with Brigadier General Joseph E. Kuhn made an inspection of possible landing fields in the vicinity of Hilo, stated that with the extension of Honolulu Park, as indicated, and the necessary preparation of the ground a hangar would be erected on the field and a detachment of enlisted men assigned for duty thereat.

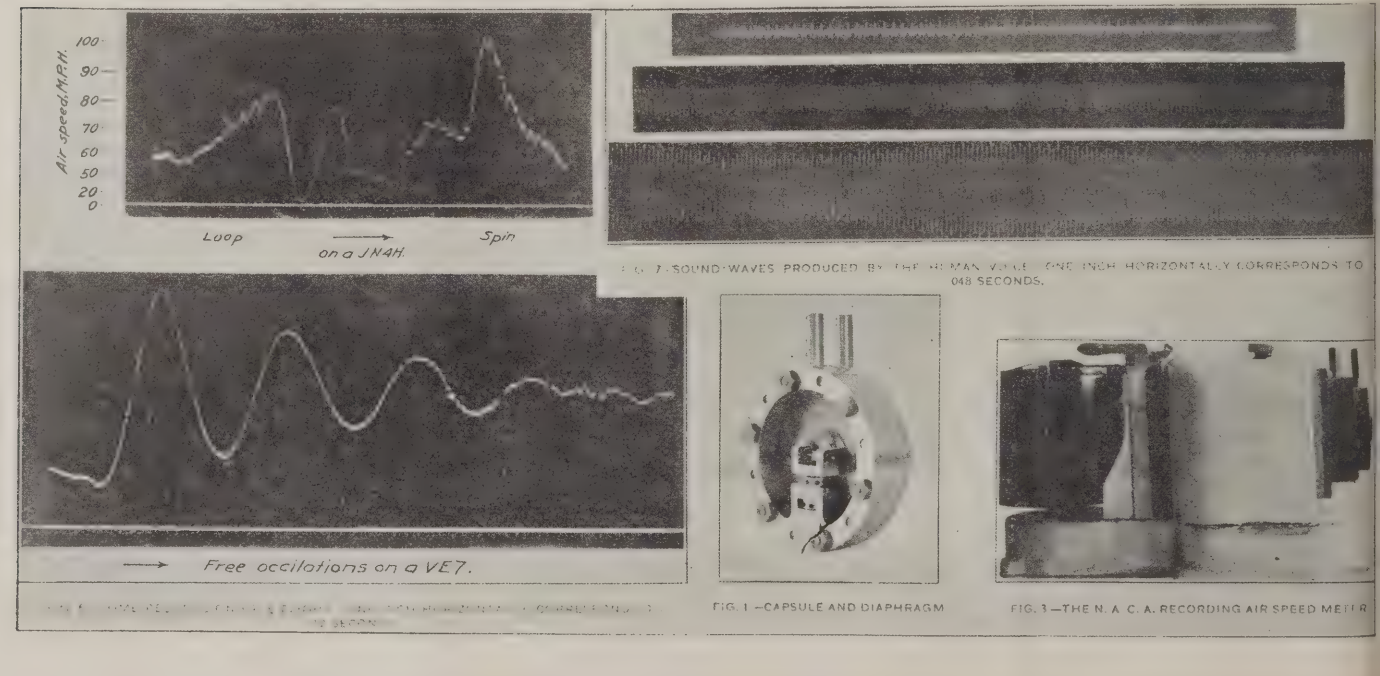


FIG. 7.-SOUND-WAVES PRODUCED BY THE HUMAN VOICE. ONE INCH HORIZONTALLY CORRESPONDS TO .048 SECONDS.

FIG. 1.—CAPSULE AND DIAPHRAGM

FIG. 3.—THE N. A. C. A. RECORDING AIR SPEED METER

THE TRUTH ABOUT OUR AEROPLANE RECORD

By MAJOR H. B. HICKAM

(Through the courtesy of the Editors of Current History, published by the New York Times Company, we are enabled to reprint Major Hickam's authoritative account of our achievements and failures in aircraft production during the war. The article originally appeared in the October issue of Current History).

IT is doubtful if any phase of our part in the war has been more before the public than our "air program." Extravagant claims, bitter denunciations, investigations and reports of accomplishment, coming in rapid succession, have created a great confusion in the mind of the public and a general desire to know just what happened to the $640,000,000 and subsequent sums that Congress appropriated without question.

When the United States entered the war the "supremacy of the air" had become of vital importance. France and England were in desperate need of aircraft of all kinds and of personnel for their operation and maintenance. Their confidence in our ability to meet their requirements was great and apparently well founded, and they lost little time in making known what was required of us. *Our air program was dictated by the necessity of our allies,* and that necessity was fully impressed upon us.

Before the war ended there were many programs, each dictated by changing conditions, but the only one which is generally known and the one upon which our production is judged is the program of June 1, 1917, upon which the appropriation of $640,000,000 was based. On May 24, 1917, the French Government requested that we co-operate to form a corps equipped with 4,500 aeroplanes with the necessary personnel for operation and maintenance. As a result of this request, and realizing its importance, the Joint Army and Navy Technical Aircraft Board met on May 25, 1917, and reported to the Secretaries of War and Navy a program for carrying it into effect. The members present were:

Major B. D. Foulois, U. S. A.
Lieutenant J. W. Towers, U. S. N.
Captain V. E. Clark, U. S. A.
Asst. Naval Constructor J. C. Hunsaker, U. S. N.
Captain E. S. Gorrell, U. S. A.

This report estimated that to meet the needs of the United States Army alone, until July 1, 1918, the following numbers of training planes would be required, and it recommended that a building program to meet these needs be started at once:

Type of Aeroplane	Number Required	Type of Engine	Number Required
JN-4	3,500	OX-5	7,000
DH-4	1,750	R-R or equivalent	3,500
SE-5	600	H-S	1,200
Spad	600	H-S	1,200
Sopwith	600	Clerget 130	1,200
JN-4 (Stop gas order)	0	Hall-Scott A7a	1,000
R-4	200	V-2-3	400
R-6	350	V-2-3	700
Farman Seaplanes	175	H-S	350

The same report also recommended that the Aircraft Production Board of the Council of National Defense take steps immediately toward obtaining from Europe—as working models—two each of the following aeroplanes (including engines), with the right to manufacture them in this country:

DH-4	Martinsyde
SE-5	Sopwith 1½ Strutter
Spad	Handley Page
Sopwith	Caproni
BE-20 Farman	Savoya
Farman Seaplane	

For the navy—in order to equip the coast stations and to train 330 pilots—the Joint Board estimated that the following would be needed, not including service aeroplanes:

300 School seaplanes with 100 H. P. engines.
200 Service seaplanes with 150-250 engines.
100 Speed scouts with 100-150 engines.
100 Large seaplanes with 200-400 engines.

To meet the request of France for co-operation in a flying corps of 4,500 aeroplanes—to be available for active service at the front during the Spring of 1918—the further needs of the United States Army were stated thus:

SERVICE AEROPLANES AND ENGINES (Latest Types)
(To be produced between Jan. 1, 1918, and June 30, 1918)

Types	Aeroplanes Fighting Line	Aeroplanes Fighting Reserve	Engines Fighting Line	Engines Fighting Reserve
Reconnaissance and artillery control	3,000	1,000	6,000	2,000
Fighting	5,000	1,667	10,000	3,334
Bombing	1,000	333	2,000	666
Total	9,000	3,000	18,000	6,000
Grand total		12,000		24,000

The recommendation of the Joint Army and Navy Technical Aircraft Board covering this service plane program was approved by the Secretary of War and the Secretary of the Navy about the same time as the recommendation covering training planes. The entire program then called for 8,075 training planes, 12,400 service planes, of which 300 of the training planes and 400 of the combat planes were for the navy, making the production as outlined for the army 20,475 planes in twelve months. The engine production estimate accompanying this plane program called for 41,810 engines in the year, with a maximum production of 6,150 per month.

Estimates were prepared after consultation with the French and British, and the total estimated cost for the program was $640,000,000. In the light of recent statements of the cost of the war that sum is not so impressive as it was when its appropriation was announced in headlines of every paper in the country. No such sum had ever been appropriated for any one purpose in the history of Congress, and it is small wonder that an admiring public pictured a sky darkened by aeroplanes. Congress had cerainly done its duty. The sum was necessary and it was appropriated without question and with no delay. The money was available, and it remained but to turn it into aeroplanes and to train the personnel for their operation.

Estimate of Our Situation

On May 12, 1917, the Signal Corps had on order 334 aeroplanes of thirty-two designs placed with sixteen firms or persons, *not more than six of which had ever manufactured more than ten planes.* There were not more than forty officers and civilians who were capable of instructing in primary flying, and none of them had ever seen a modern fighting or service type aeroplane. No firm had ever produced anything but an elementary training plane, and there were not more than ten men capable of designing them. The situation with respect to engines was little better, although several far-sighted automobile manufacturers had experimented with aeronautical engines with some success. Most of the instruments and accessories of aircraft had never been heard of, and it was necessary to create a new order of instrument manufacturers capable of producing in great quantity, barometers, compasses, tachometers, speed indicators, angles of incidence indicators, thermometers, synchronizing mechanism, bombing sights, bomb release mechanisms, electrical gun and clothing heaters, automatic long range cameras, special radio apparatus and other super-sensitive instruments, the skill to make which did not exist in this country.

The program had been approved, the money appropriated, and the crying necessity for its accomplishment was only too apparent. The best of those whose previous experience seemed to fit them for the gigantic task were assembled and the fulfillment of our promises intrusted to them. These were men accustomed to success. No proposition had ever been too big for them, and they were determined to succeed. After a careful survey of the situation they were convinced that the program, huge as it was, was not impossible of accomplishment, and in their enthusiasm and determination they announced that they would carry it through. That announcement was transmitted through the press to every citizen of the country in such glowing terms that it can never be forgotten.

There is a popular impression that our air program was a failure, and that the money so generously and trustingly appropriated was squandered without adequate return. It is certain that if our accomplishment be measured by what we in our enthusiasm and ignorance announced we were going to do, then we failed, indeed; but if it be measured by the accomplishment of other countries under similar conditions, then even the most critical can find much cause for satisfaction.

As It Looked in 1917

The possible aircraft production facilities of the United States, as they appeared to thoughtful men at that time, were set forth on June 13, 1917, in a long letter written by Howard Coffin, Chairman of the Aircraft Board, to Brig. Gen. Kuhn, Chief of the War College Division. Though this letter is too long to print here in full, any one who will consult it in the War Office files will find it very illuminating. It shows that the early statements of what we could do were no vainglorious boasts, but were the result of a very careful analysis of the situation, based on all available information. Mr. Coffin outlined, item by item, how we apparently could and should go about the building of 5,000 training machines, 2,500 DH-4s for reconnaissance, 800 of each of three types of pursuit planes, and 12,000 fighting, bombing, artillery control and reconnaissance machines. He specified the aeroplane and automobile factories to which each type was to be assigned, and gave a complete list of thirty or forty others that could be enlisted in the work. The following passages show just how the situation looked and what was planned:

> We will concentrate on the reconnaissance and artillery control types, relieving French factories of the heavy production of these types. This will permit them to concentrate on fighting types utilizing the rotary engines. In the meantime, the rotary engine production will be materially increased in this country. With the U. S. 8 A and U. S. 12 A in quantity production before January 1, and the Lorraine-Dietrich by March 1, 1918, we can meet the increased reconnaissance and artillery control program. With designs from Europe on or before August 1, it will be possible to have planes in November from Curtiss and in December and January from sources of supply established to make training machines, but switched over to these as training orders are transferred to other new sources of supply. The output of these planes will temporarily exceed that of engines.
>
> It is estimated that production of these types will have to reach and hold 1,800 per month by March, 1918. The Curtiss Company has estimated they can reach an output of 30 per day, or 750 per month, of pursuit or fighting machines by January 1, 1918. We expect to have at least two other sources of supply equal in size and capacity to the Curtiss Company and to mobilize the productive capacities for wood working of some centres like Grand Rapids, Amesburg, Philadelphia and Camden, Cincinnati, Syracuse, Kansas City and St. Louis. * * *
>
> The automobile industry is producing 100,000 engines per month, while the maximum required by the aeroplane engine program is 6,000 per month.
>
> We firmly believe the aeroplane program can be met. We believe that the Aircraft Production Board can arrange for the production during the next twelve months of an engine for every plane and at least a spare engine for every five planes. The deficit in spare engines for training machines will be made up during the Spring and the deficit in engines for combat machines will be made up during the Summer of 1918.
>
> The problem of increasing the production of French and English factories has been suggested but there are so many questions involved in the transportation of all kinds of material, men, food, clothing, etc., that it seems best to defer an opinion on this point until our board has made an investigation of the subject abroad.
>
> The program as submitted to the Aircraft Production Board is a gigantic one, but capable of accomplishment as outlined, provided funds are quickly appropriated and no delays permitted.

Causes of Partial Failure

Why did fulfillment in some respects fall so far short of these expectations? The reason is that, careful as was the Aircraft Board's estimate, it was based in part on premises which afterward proved to be false. Chief among these were (1) the idea that engine production was harder to build up than plane production; (2) that the quantities of raw material needed were comparatively small and would not conflict with demands in other lines, and (3) that the manufacture of aeroplanes presented no special difficulties which existing factories could not easily meet. The rapidity with which planes and engines were becoming obsolete on the front also was not known, nor was it realized that difficulty would be experienced in getting the Allies to furnish sample planes and drawings for purposes of reproduction in this country.

The comprehensive inexperience of the United States in the manufacture of aircraft when we entered the war undoubtedly accounts for our overconfidence and for the heartbreaking delay in getting under way. The source of knowledge was 3,000 miles away, and development there was so rapid that it became necessary to go to the scene of actual conflict to gain our knowledge of what to produce. Perhaps it was fortunate that the difficulties which were soon to appear were not anticipated. Our advent into the war was at a time when the development of special types of aircraft for specific purposes was at its height. Planes which were considered adequate one month were inadequate the next, and the combatants were striving to outdo each other in design as well as quantity production.

Foreign aeronautical engines are mostly hand-made; all our engines are machine made. It is readily seen that all the advantage in changing design lies with the hand-made engine. If we were to go into quantity production it was necessary to select engines that would not become obsolete before they could be produced. The same thing applied in a lesser degree to plane manufacture. Our lack of aeronautical engineers with the necessary experience made it necessary to make "Chinese copies" of both planes and engines. Great care must be exercised, therefore, in the selection of what we were to duplicate. Early in the war the Bolling Commission was sent abroad to confer on the ground with our allies and to select and ship back the planes and engines that were to serve as patterns. This could not be done in a day. In the meantime we could not sit idle.

In the Curtiss JN-4 we had an elementary training plane which had given satisfaction, and except that many important shop practices were not of record but existed only in the minds of certain operatives of the Curtiss Company, the knowledge for production was at hand. Our program required large quantities of training planes at once, but after the initial supply had been produced only a small part of the industry would be required to replace wastage. The experience gained and the industry built up could then be turned to the production of service planes. Orders were placed with eleven different contractors, and production started.

The Liberty Motor

Early in 1916 the Simplex Company had obtained the design and rights for manufacture of the Hispano-Suiza motor. This engine was further advanced in standardization than any other foreign motor, and the Simplex Company had the advantage of the assistance of a group of foreign experts. It was not until February 6, 1917, thirteen months later, that the first motor turned over under its own power, notwithstanding the company had every inducement for rapid delivery. The General Vehicle Company had had a similar experience in the manufacture of the Gnome 110 H. P. Here were two significant examples of the time required to put standardized foreign engines into production. Both these engines were considered to be of the best when they were selected for production, but both were inadequate for anything but training before they could be got into quantity production.

With these examples before us it was evident that we could design and build an engine suitable to American manufacturing methods long before we could receive and duplicate any foreign engine. The idea of the Liberty motor was the result. Much criticism of the Liberty has been indulged in, but the wisdom of producing it is now so apparent as to make any comment unnecessary.

The Liberty motor is a combination of the best elements of American motor manufacture. Every secret of the industry was offered without reservation, and the Liberty, as its name indicates, is an enduring tribute to the patriotic spirit of American manufacturers. That everything that was offered could not be used detracts in no way from the splendid spirit that was shown.

As the development of types progressed, engines with increasing horse power were demanded. In May, 1917, our foreign advisers agreed that we should concentrate on an engine of about 225 horse power, and the Liberty-8 was designed to meet this demand. In less than three months development had been so rapid that all agreed that a horse power of 330 at least would be required. Fortunately, the development of the Liberty-12 had kept pace with that of the 8, and as a consequence the Liberty-12 went into production. The first type developed the required power, but before quantity production had well begun this was considered inadequate, and a redesigning of parts and many improvements resulted in an increase of over 100 horse power. The Liberty-12 today develops 440 horse power, and the end is not yet in sight.

Experience has shown that at least six months' service on the front is necessary to "get the bugs out of any new engine," but the foresight of our air service in the A. E. F. in preparing for the examination and test of the first engine to reach the zone of the advance, and the promptness with which suggestions for improvement were cabled home, shortened the expected time by months. These necessary and anticipated criticisms were given undue publicity, which resulted in much

loss of faith on the part of of those inexperienced in gas engine development.

The difficulties encountered in going into quantity production were of a very serious nature. Existing motor building plants did not have machinery of sufficient size to handle the parts of a motor as large as the Liberty, and it was necessary to build and design tools for the purpose. Some 300 jigs, tools and fixtures are required to produce the necessary parts, and these had to be duplicated many times for quantity production. Thousands of men and women had to be trained and educated before they could be intrusted with the manufacture of parts which required a degree of skill they did not possess, and many of these were requisitioned for other necessary governmental activities as soon as they were trained.

Modern warfare demands the coordination of every phase of human activity, and all activities must be speeded up to the limit, notwithstanding the fact that many of the best and most efficient producers must be withdrawn for service with combatant troops. The draft, therefore, took many machinists and mechanics at a time when their services were vitally important, and fuel, transportation and materials had to be shared with those engaged in other phases of our military program.

First Deliveries of Engines

Production, however, started with the delivery, during December, 1917, of 22 engines of 330 horse power. After about 300 of these engines were in production the horse power was stepped up to 375. This required a strengthening of many parts and a change in many tools. Information from abroad indicated that if an engine of 300 horse power could be produced, the United States would lead the world in size and power of engines for 1918-1919.

After changes which necessitated a redesign of many jigs, tools, etc., and metallurgical changes in some of the parts which required the development of new and better methods of making steel, the Liberty went into final production with the enormous horse power of 440. So rapidly were these changes made that by May 29, 1918, one year after the date design was begun, 1,243 Liberty engines had been produced and delivered for service. Six months later the rate of production had reached the sum of 46,500 per year, and was increasing by leaps and bounds. On Oct. 30, 1918, our production rate of Liberty engines alone was far greater than England's rate of production for *all* her aeronautical engines.

Up to Nov. 29, 1918, a total of 15,572 Liberty engines had been produced, but that by no means represents the accomplishment in motor production, for the production of engines for primary and advanced training was over 16,800. In the month of October, 1918, America produced 3,878 Liberty 12s, 753 Hispano-Suizas, 309 Le Rhones, 357 other program types (OX-5, Lawrence, Gnome and Bugatti) and 32 experimental engines, a total of 5,329. The rate of production was increasing daily, and by Nov. 1, after eighteen months of war, we had reached a rate of 64,000 engines per year. A comparison with English and French production reports is illuminating. From the best available data, it is as follows:

ENGINES PRODUCED

	France	Italy	England	U.S.
1914	1,065	.....	99	11
1915	7,089	600	1,721	20
1916	16,785	2,400	5,363	134
1917	23,092	6,300	11,536	2,431
1918	44,563	15,000	22,102	34,241
1919	.....	.....	....	5,486
Total	92,594	24,300	40,821	42,323

During the years 1914-16, inclusive, the combined engine production of the Allies was only 35,122, yet they did not hesitate to demand that we produce 6,000 more than that number in one year, nor did we hesitate to promise to do so. During 1918 we actually did produce 34,241, and had we maintained the October production rate after the signing of the armistice we would have exceeded the demand made upon us. This is hardly a record of failure.

"Fighting Planes"

Probably the most bitter criticism of our air program is that "not one American-made fighting plane ever reached the front." It is small wonder that disappointment should be centered on this point. We entered the war to fight, and no small part of our effort was to be in the air. It is a fact that no American-made pursuit planes did reach the front. Acting on the advice of our allies, and finally realizing our inability to design and produce a pursuit plane capable of holding its own, we decided to leave the production of pursuit planes to the French until American engineers could master the new and intricate problems of design and production. In the meantime, we were to produce, for training purposes, American copies of the best models available anywhere.

The wisdom of this decision may be questioned by some, now that all the facts are available for study, but it is doubtful if even the most ardent critic would have decided otherwise had he been placed in the position of those who had to determine the policy.

No one except those who are actually engaged in the attempt to determine what to produce can ever realize the lack of definite information upon which to base a decision. Our source of information was 3,000 miles away, and the means of communication a cable choked with other essential business. During the six months from June to December, 1917, plans were made on information that afterward proved to be inadequate, necessitating change after change.

Signal Corps records show that from 1908 to 1916 the total number of planes delivered to the army was 54, while in 1916, due to requirements of the punitive expedition into Mexico, 366 had been ordered, of which only 64 were ever delivered. These were of the most elementary type. With this record of achievement of a starved and struggling industry, we were called upon to embark on a program calling for over 20,000 planes in a year. Of these, less than 25 per cent. were of a type then known to our industry. Of the remainder, we were without practical knowledge, drawings or designs. *In fact, we never at any time received a complete model or set of drawings.* "Millions may be appropriated in a day, but money cannot turn back the hands of the clock and permit the gaining of the experience and ability which make aeronautical engineers competent to undertake the vitally important problems which confronted us." (Letter of Colonel Waldron to Dr. Walcott.)

It was obvious that our only hope was to select the best of each type and to produce that until something better had been developed abroad or in the United States. Development, particularly in "fighting planes" or pursuit planes, was very rapid. Even those who had all the front-line experience could not look far enough ahead to determine future requirements. Planes representing the latest and best thought were often obsolescent before they reached the front. Confusion has resulted from the fact that planes such as the Spad, Nieuport, Sopwith and others retained their original name no matter how many changes or improvements were made in them. Critics demanded to know why we didn't select the Spad and turn it out in large quantities. It takes even a highly organized and well-trained industrial concern a long time to reproduce a perfect model, and longer to get into quantity production on it. Certainly we had no such concern available. The plane produced under conditions existing in 1917 would have been obsolete long before it left the United States.

Using France's Experience

The decision, therefore, was to furnish the French with raw materials and to have our pursuit aviation equipped with the latest and best plane that French engineers of long experience could produce with a highly trained, experienced and well-equipped industry behind them; an industry, by the way, that could not have continued in production without our raw materials. In no other way could our fighting pilots have the latest and best equipment during the year 1918.

A pursuit plane is very complicated in design. It must operate at sea level or at an altitude of over 20,000 feet; it must be fast and must climb rapidly, characteristics which are opposed to each other in design. A very delicate compromise is required to give the necessary performance. It must be very manoeuvrable, have good visibility and be well armed. Even today development continues very rapidly with no end in sight. No American engineer had ever seen one, to say nothing of having designed one. Yet there is still criticism because we turned over the production, in those early days of uncertainty and inexperience, of such planes to experts who unfortunately were French rather than American, but who, nevertheless, were allies fighting and working side by side with our pilots in a common cause.

We actually did bend every effort toward the design of an American-built pursuit plane, with the result that the first design of the MB-3, now recognized as one of the best in the world, was turned out and tested early in 1919. There were others just as promising in sight, but, while there was American ability in plenty, there was no *time*.

There are two general classes of planes required—elementary training planes, in which pilots are taught flying, and service planes, in which they operate over the front lines. There are, again, two general classes of service planes—air force, i. e., pursuit, bombardment and attack, which apply force from the air, and air service planes, which serve the different elements of the army by reconnaissance, liaison, spotting artillery fire, etc. The duty of the first class is to fight;

the second class fights only for self-protection, to enable its mission to be carried out in spite of attack.

The Bolling commission reported that the British DH-9, which was just emerging from the experimental stage, had reached a degree of development which would enable it to give excellent service, no matter how long the war might last. This was an air service or observation plane, which could also be used as a light day bomber. If we could produce this in large quantities, we could turn out equipment that would always be useful, even though a better plane might be developed. Here was something we could go ahead on with confidence, if we could get a model or a set of production drawings. This was, however, impossible at the time, so the determination was made to go into production on the DH-4, which was then in use by the British in the front and continued in use, by the way, until the end of the war.

Success With Observation Planes

On Aug. 15 the first DH-4 arrived at Dayton. It was without engine, ordinance and many accessories for its use. A set of incomplete drawings accompanied it. The fuselage design had to be changed many times in order to accommodate the Liberty-12 and the instruments and accessories necessary for its operation. On October 29 the first DH with a Liberty motor was flown successfully, and during the next four months the infinite complications of installing the equipment demanded were solved and production started with the delivery of fifteen machines in April, 1918. By October the rate of production had reached 1,097 a month. In the meantime, many changes and improvements had been made as the result of criticism and recommendations from the A. E. F.

On Nov. 11, 1918, 196 DH-4s were actually in use at the front, 667 had been received at the front, 293 were at A. E. F. training schools out of a total of 1,440 planes actually received in France, and 1,040 more were en route. A total of 4,846 had been produced. With the exception of 100 Handley Pages shipped to England for assembly, this represents our total production of planes for service at the front.

Our program for the production of service planes called for 12,000 of three general classes. This really meant about 18,000, for about 50 per cent. spare parts were considered necessary for maintenance. This item may represent in a small way our ignorance and inexperience in May, 1917. These planes were to be produced between Jan. 1 and June 30 if we were to fulfill our promises. Had we been informed of the maximum rate of production that France and England, with their years of experience under pressure, had been able to attain, the absurdity of such a program would have been evident. The following table, taken from published reports, gives the plane production of the Allies:

AEROPLANES PRODUCED

	France	Italy	England	U. S.
1914	541	.....	245	11
1915	4,469	400	1,932	20
1916	7,549	1,300	6,149	83
1917	14,915	4,000	14,421	1,807
1918	23,669	6,500	32,106	11,916
1919	.....	....	.....	409
Total	51,143	12,200	54,855	14,246

During the years of 1914-16 the combined production of the Allies was only 22,585, yet we were expected to produce as much in one year, and that with practically no previous experience. During the year 1918 we actually did produce 11,916 planes—more than the entire production of either France or England up to the time we declared war.

While our production was getting under way, training and service machines were needed by the air service in the A. E. F., and it was recognized that for many months it would be impossible to meet this requirement with planes manufactured in the United States. Accordingly, orders were placed with French factories for 5,875 planes of French design, with delivery promised by July 1, 1918, and promises were made to the French industry for the delivery of great quantities of raw material. Neither the United States nor the French Government was able to fulfill its promises. *However, 22,500 tons of raw materials and fabricated parts were furnished the French,* and 4,791 planes were delivered to the air forces of the A. E. F. before Nov. 11, 1918.

There have been many statements to the effect that American aviators flew planes of obsolete type turned over by the French, but records of delivery show that we fared even better than the French themselves. It requires about a year before a plane which is accepted as an improvement replaces equipment on the front, and there have been many cases of planes becoming obsolescent before they ever reached quantity production. These planes were used on inactive sectors and for training, and it was only just that we take our share of such equipment. After July 1, 1918, we received nothing but planes of the most approved type.

Furnishing Raw Materials

Our accomplishments in production, however, can by no means be measured by the number of planes produced. We had to furnish all the spruce, and later much of the fabric and dope, as well as wire and steel fittings, for France, England and Italy. A preliminary survey disclosed an appalling shortage of spruce, linen, castor oil and acetate. The failure of any one of these essential raw materials could cause the collapse, not only of our own program, but of that of the Allies as well. In meeting such problems we were in our element; given a reasonable amount of time, they could be solved, but time was the essential we lacked. *Already we were attempting to crowd the development of ten years into as many months, and any delay would be fatal.* Judged by peace-time production costs, many of the expenditures made may seem excessive, but the value of time can be measured only by the pressure of necessity, and certainly our necessity justified the expenditure of any sum required to produce results in time.

Acetone is necessary for the manufacture of cordite, an explosive upon which the British were absolutely dependent. Our aircraft program called for 25,000 tons. Estimates showed that the total available supply would not even meet other demands. One of the essential products was totally lacking. The entire supply of acetate of lime, as well as that of other refined ingredients, was commandeered; 170,000 tons were required, and only 106,000 were available. The requirements of all the Allies were pooled, and the best chemists in the country were secured to master the intricate technical requirements of production. Many previously unconsidered sources of supply had to be discovered, and after large chemical plants had been developed by governmental support, the demand was met, and 1,324,356 gallons of dope were manufactured from original sources which proved to be more than adequate for all requirements.

As early as the Spring of 1917 a serious shortage of aeroplane spruce had developed, and in order to secure spruce fast enough to meet our own and allied production needs, the Spruce Production Corporation was organized in the Pacific Northwest. New and hitherto inaccessible sources were opened up in order that the flow or aircraft lumber might not stop with the exhaustion of the accessible supply. The problem of procuring spruce for aircraft presented new problems to our lumber interests and too much credit cannot be given for the manner in which they were solved. Education in new methods of logging, sawing, drying and utilization of spruce was necessary, and the knowledge gained in the solution of the many and varied problems will be of lasting benefit. As a result of improved methods the requirement per machine fell from 5,000 feet to 1,000 with a consequent reduction of expense in all departments. Over 180,000,000 feet of aircraft lumber was shipped, *of which* 120,000,000 *went to our allies* and 60,000,000 to our own industry.

With the collapse of the Russian Government, one of the two great sources of linen was lost, and by December, 1917, it was realized that the air program of the Allies as well as our own would depend upon the development of a suitable substitute. England's reputation as the greatest cotton-manufacturing centre of the world is well established, but the cotton fabric used as a substitute for linen was developed in the United States by our own experts to meet the needs of our own program. The physical characteristics of our cotton fabric equal those of the best linen, and it was produced at just half the cost. Had not American genius produced a substitute superior to the original, after years of England's best effort had been unsuccessful, our program would have been brought to a full stop before it had well begun. In August, 1918, our production rate was 1,200,000 yards per month, and every yard meant a saving of 65 cents.

Important Discoveries

The castor oil situation was very similar to that of linen and acetone. Before Liberty Aero Oil was developed, castor oil was the only satisfactory lubricant for high speed motors and the quantity required for our program was enormous. The Government's country-wide round-up of castor oil robbed every small boy in the United States, but had not the Lubrication Division succeeded in developing a satisfactory mineral oil for the Liberty and other stationary engines, the supply would have been utterly inadequate.

Wherever our industry could obtain adequate knowledge of what was required, there is no record of failure. Had it been possible to make the American people acquainted with the true condition in 1917, and had they been kept informed of difficulties as they appeared and of the steps taken to overcome them, the feeling in regard to our aircraft production would be one of pride rather than of disappointment.

NAVAL and MILITARY AERONAUTICS

Army and Navy Estimates

Washington.—Estimates for Army and Navy Air Service, which have been sent to Gen. Charles G. Dawes, Director of the Budget, call for appropriations aggregating $30,000,000 for the fiscal year beginning July 1 next.

Last year estimates for the two services aggregated $70,000,000, and Congress appropriated $33,613,431, of which the army received approximately $19,000,000 and the navy about $14,500,000. As heretofore announced the Army Air Service estimate is for $13,000,000, while that for the navy in $17,000,000.

France this year is spending $58,816,684 on aviation, and England $92,378,836. The British estimates for next year are said to be $113,757,024, while the French estimates for 1922 have not yet been received.

Japan plans an expenditure of $19,685,260 on aviation in 1922, and has a seven year air programme calling for an expenditure of $200,000,000.

In the light of what other Governments are doing in the way of aviation development, present and prospective, American flying men are not at all happy over the prospect of still further reductions in appropriations. These they feel already have been cut below the point of safety, especially in view of the showing made by army and navy aircraft against the former German warships off the Virginia Capes during the summer, and by army aircraft against the old battleship Alabama in Tangier Sound, Chesapeake Bay, last month.

It is felt that the $13,000,000 proposed for the Army Air Service will do little more than cover the cost of operation and upkeep. Flying officers point out that the cost of operation is necessarily much higher because of the large amount of old material and equipment left over from the World War.

Should Congress show a disposition to be more liberal, doubtless both aviation services will be prepared to submit further estimates. For example, while the estimates for the navy are about $2,500,000 more than the appropriations for the current year, the fact that the personnel must be paid out of this fund next year, in effect, would mean an actual reduction if Congress should grant the full $17,000,000 asked for.

This amount would enable the Bureau of Naval Aeronautics to keep up its reduced establishment and carry on a curtailed programme of advancement. Experiments are now being conducted with new types of planes with a view to developing one that can land on the deck of a battleship.

Naval Fliers Fight Cut in Rank and Pay

Norfolk, Va.—Congress next week will receive a strong protest from naval aviators who have served America since the war, many of whom were notified October 14 that they had failed to pass an examination held last May and either would be reduced in rank, with a corresponding reduction in salary, or dismissed from the service.

More than 385 men, comprising the entire Naval Reserve aviation force, are affected by the order. Out of sixty men at the air station at the Hampton Roads naval base only fifteen passed the examination and none of them will retain his present commission as Lieutenant.

The aviators declare they have been badly treated by the aviation officials of the Navy Department. They say they were required to stand an examination on matters that had no bearing whatever on flying, 70 per cent. of the questions they were required to answer pertaining to the navy, seamanship and knowledge of a battleship.

It is stated that aviators who have made the best records of any flyers in the world and who never had been on a warship were asked to explain various parts of a ship and the duties of a sailor.

The men say they joined the Aviation Corps to fly and they know their business perfectly. They admit they know little or nothing about a warship and do not believe they were treated fairly in being required to stand an examination in which only 30 per cent. of the questions relate to flying.

The reservists charge that the Navy Department is "sacking" its best aviators to make room for "rookies from Annapolis." Aviators who since the world war have held commissions as lieutenants, who passed the "nautical examination," have been reduced to ensigns. Young recruits from Annapolis, without any experience as aviators, will receive the same commissions as the old flyers and will outrank the reservists who manage to "retain their scalps."

Under the orders from the Navy Department such aviators as Lieut. Hinton, who piloted NC-4 across the Atlantic Ocean; Lieut. Laval, winner of several aviation endurance honors and Lieut. Williams, who made an excellent record in the bombing manoeuvres recently held off the Virginia coast, are reduced to the rank of ensigns.

Under the old arrangements aviators were rated according to their experiences. The man who had the greatest number of hours in the air to his credit, in conjunction with long service, was first in line for promotion. Some aviators who have been in the service for four years have as much as 1,200 hours in the air. The average, however, is about 750 hours. Lieut. Hinton is said to be among the first aviators of America or any other country with more than 1,000 hours in the air to his credit. His record as a pilot is second to none in America.

Lieut. Laval was one of the leading competitors in an international aviation contest and finished among the winners.

In the recent bombing off the Virginia Capes in which the navy participated, all the planes were manned by reserve officers. The best records were made by reserve officers, and the best time was made by machines manned by the reserve forces. America depended on the reserve forces during the experiments for an efficient air corps, it is asserted, and the officers do not believe they should be "sacked" now to make way for Annapolis recruits. The officers say the department plans to send Annapolis recruits to an aviation school at Pensacola, where they will be trained three months in the art of handling air machines. At the end of that time they will receive commissions as ensigns and be sent to naval air posts, where they will be placed over older and more experienced aviators.

A petition is being prepared by reserve aviators to be presented to Congress and to the Navy Department. The aviators want the department to order another examination, with the questions based on flying, the upkeep and mechanism of air machines and other things that experienced airmen should know.

Senators who will take the aviators' case before Congress are Penrose of Pennsylvania, Swanson of Virginia, McCormick of Illinois, Wadsworth of New York, Simmons of North Carolina and others. Aviators from all over the country already have written to their Congressmen to take up the matter with the Navy Department. A delegation of airmen, representing every navy station on the coast, will visit Washington to present their case in person to Congress.

Fleet Will Test Anti-Aircraft Guns on Rag Men in Gliders

Norfolk, Va.—Rag men will be used to "man" a fleet of gliders that will be under fire of anti-aircraft guns on ships of the Atlantic fleet in forthcoming maneuvers off the Virginia Capes and Cuba the latter part of the winter. It is planned to launch the gliders from navy dirigibles at a height of from 3,000 to 5,000 feet. The rag men will be fastened in the gliders to prevent the machines from turning over in the downward flight they will take after they are released. The presence of the rag men in the gliders will also give American gunners using small arms a chance to prove their marksmanship in picking off crews of an aerial enemy craft.

It is proposed to release the gliders in groups of five. Naval experts say the gliders, in their flight downward, will maintain an average speed of about forty-five miles an hour, about half the speed an aviator in full flight would average in an attempt to escape gunners on warships after delivering an attack.

Practically every ship in the Atlantic fleet will take part in the attack of the gliders.

An elaborate program of aerial target shooting and maneuvers is being prepared for use when the Atlantic Fleet goes to Guantanamo the coming winter. Most of the fleet will assemble off the Virginia Capes within the next few weeks for preliminary target practice, which will include experiments with gliders and box kites. The latter style of targets has been used in previous aerial target shooting and resulted in excellent records for navy gunners using small arms. Box kites are made fast to ships with ropes and permitted to soar at heights varying from 500 to 1,200 feet.

The gliders will be larger than those used in land maneuvers by the army and navy. Each glider, it is said, could easily carry two live men with utmost safety.

FOREIGN NEWS

Air Customs Fleet to Patrol Channel

A new aviation problem has developed here which probably will be solved by the organization of a squadron of flying customs inspectors. Numerous forced descents on the cross-Channel air route have been observed to be marked by the disappearance of certain passengers, and the police are convinced that such incidents are really attempts—usually successful—to smuggle in valuables from London, Brussels and Holland, chiefly cut gems, which find a ready market here.

The law says that when a machine is forced to land outside the appointed landing area all passengers must remain with their baggage untouched until the customs police arrive. In most cases, however, this would require remaining in the cabin of the planes over night, as few direct trains follow the route taken by the aeroplane service.

Most of the customs officials are loath to risk their lives in planes, and have consented to the formation of a special air division which will be called by wireless from Paris or Boulogne whenever flights must be abandoned owning to defective machinery.

Aviation in India

The Air Board of India, under the Commerce Department, is a purely advisory body without executory functions. As soon as funds are available, the Government of India has decided to prepare a trunk air route from Rangoon (via Calcutta and Allahabad) to Bombay. When this route, or a section of it, is completed, tenders will be called for an air mail service over the completed portion. Local governments in India have also been empowered to lay out air routes within their own boundaries.

Airdrome Police in China

For the purpose of maintaining peace and order of airdromes the Aeronautical Department has recently organized an Airdrome Police Training Corps, which consists of 160 men divided into four groups commanded by a commander-in-chief. The work of this new organization was completed on June 1st. When the Pekin-Shanghai air-line begins its service these policemen will be sent to different airdromes for duty.

The Aeronautical Department has engaged four new pilots from England and America for service in connection with the Pekin-Shanghai air service, which, according to latest reports, was scheduled to start on August 1st. These pilots are Captains Jones, McMullin, Campbell Orde, and C. H. Dolan.

The five students sent by the Aeronautical Department to England to study aeroplane construction have completed their courses after one year's hard study. Three of these students have been assigned to the Tsin-ho Aircraft factory, where technical experts are needed. The remaining two were ordered to America to continue their studies in Military Aviation.

Franco-Roumanian Agreement

The Roumanian Minister of Communications has been authorized to sign a contract with a French Company, the Franco-Roumaine de Navigation Aerienne, under which the Company has the right of air transport in Roumania on the Paris-Strasburg-Prague-Vienna, Budapest-Belgrade-Bucharest-Constantinople air route over a period of 20 years. The agreement carries with it an annual maximum subsidy of 6,500,000 lei to the Company in return for certain guarantees, including the placing of its material and personnel at the disposal of the Roumanian Government in the event of mobilization.

Japanese Aviation

The program of the Air Bureau includes the consolidation and encouragement of civil aviation, the supervision of private undertakings, and the establishment of an international air route. Civilian pilots are to be trained at the military Aviation School, 292 applications having been received for 10 vacancies available in 1921.

German Aviation

The following special article in the New York *World* is of interest:

Germany's first air traffic timetable has just been published here. It contains many interesting facts about the development of Germany's peaceful air fleet, which leading air navigation experts claim will become a strong competitor of the republic's newly organized railroad system at the very moment that the Entente lifts the ban on the building of planes intended for peaceful air traffic.

The Versailles Treaty forbids Germany to manufacture aeroplanes or parts thereof, nor is she permitted to import air navigation vehicles of any sort. Germany was furthermore required either to deliver to the Entente or to destroy her entire air fleet, numbering about 10,000 machines.

To-day Germany is rebuilding on the wreck of the old an entire new air fleet of modern construction. Just as the old engineers of the Hamburg-American Line and the North German Lloyd provided for plenty of space and comfort when they planned the construction of their pre-war passenger steamers, the modern aeroplane factories of Germany are equipping their planes with large, comfortable cabins and staterooms. The marvellous success of the extended air service which enterprising flyers and aeroplane builders started only a year ago may be ascribed to the generous support given it by the great industrial magnates and steamship companies like Hugo Stinnes, the Hamburg-American Line and the North German Lloyd.

In the first eight months of this year 3,714 scheduled flights were made, against 1,878 flights in twelve months the year before. This not only indicates that this year more flights were made compared with last year but also that new air routes were opened and more planes were added to the fleet. The German Air Navigation Service, as the associated enterprises call themselves, has to-day again 150 aeroplanes of one type or another at its disposal.

The new air service schedule just published shows that Berlin has been made the centre of all important air routes.

From Berlin there are daily trips to and from Brunswick, Dortmund, Dresden, Hamburg and Bremen, extended by the Baltic Air Service of the Sablatnig aeroplane firm to Travemuende, Warnemuende and Sassnitz, making connections with the steamers leaving those towns for Sweden, Norway and Denmark.

Then there is the Danzig Air Service, which co-operates with the Sablatnig service in maintaining the flying routes between Berlin and and the East Prussian route—Danzig, Koenigsberg, Memel—with connections at Riga and Reval.

The Lloyd Air Service Sablatnig has an additional route from Berlin to Westphalia, Muenster, Bremen, Wangerood.

The Rumpler Air Service provides planes for the Berlin, Leipzig, Nuernberg, Munich, Augsburg route, and at Munich the Bavarian Air Lloyd provides transportation facilities by air to Constance.

Another direct service between Stuttgart and Constance is furnished by the Staehle Air Line.

Then there is the Deutsche Luftlloyd, which has several planes travelling daily from Berlin over Magdeburg to Hamburg and Bremen, and from Bremen over Magdeburg to Leipzig and Dresden. At Hamburg and Bremen connections can be made with Dutch and Danish air lines for Amsterdam, Rotterdam and Copenhagen. From Amsterdam and Rotterdam, French and English planes take passengers to London or via Brussels to Paris, where air connections can be made for Spain.

The schedule contains all the different air service lines established in Europe up to August, 1921, as well as the different prices charged by them. Although the price for benzine and gasoline is much higher in Germany than in all the other countries the fares on the German air lines are the cheapest.

Travellers coming to Berlin can fly for two hours all around the surrounding districts for 200 marks—about $2 at the present rate of exchange. This price even includes the automobile from the offices of the Hamburg-American Line or the North German Lloyd, both of which are in the downtown district, to the flying field, some ten miles out of town.

A ticket from Berlin to Amsterdam costs only 450 marks and 75 gulden; from Berlin to Brunswick, 350 marks; from Berlin to Bremen, 450 marks; to Danzig, 900 marks; to Augsburg, 1,725 marks.

So far 5,581 persons have been transported by the regular air service this year. During all of last year only 2,030 persons were carried.

This shows how rapidly the new air passenger service is developing in Germany in spite of the prohibitive articles of the Versailles Treaty.

The Brussels Meeting

On Sept. 3rd-4th the Aero Club Belgique held a meeting at Brussels, the two principal events being a Belgian Flying Corps Squadron Race for "La Coupe Challenge des Escadrilles" and a race for touring aeroplanes under 100-h.p. for "La Coupe Simonet."

The former race was held over the course Brussels-Ostend-Brussels, and resulted as follows:—Single-seater: 1st, 1er Escadrille Technique; 2nd, 10e Escadrille; 3rd, 9e Escadrille. Two-seaters: 1st, 2e Escadrille Technique; 2nd, 6e Escadrille; 3rd, 2e Escadrille.

"The Coupe Simonet", a competition for sporting or touring aircraft possessing qualities of economy, ease of dismantling, variation of speed, etc., resulted as follows:—1st, Bossoutrot (Farman-Sport), 63.9 pts; 2nd, Van Cotthem (Central Aircraft Co. "Centaur 4"), 53.3 pts.; 3rd, Pelletier d'Oisy (Morane-Saulnier), 45 pts.; 4th, Mlle Boland (Caudron), 44.4 pts.; 5th, Martin (Avro "Baby"), 35.5 pts.

Aviation in Australia

Probably Canada is the most forward of the Dominions in the development of aviation, but Australia seems determined not to be left behind in the race. According to a Sydney correspondent of *The Times* Trade Supplement, the Commonwealth Government has now decided upon a definite line of policy, and, as a first step, practical encouragement is to be given to the manufacture of aircraft locally. The Australian Aircraft and Engineering Co., of Sydney, has been firmly established and the Government has placed with it an initial order for six machines of the 504 K Avro type. The works are adapted to rapid expansion, and the industry is expected to grow, especially as commercial aviation develops. The only materials that will have to be imported for the construction of the machines noted will be the fabric, ball bearings, steel bracing cables, and a certain amount of raw steel for making component parts. The 504 K type has been adopted by the Government as a standard, and a sufficient number of these machines, together with all necessary spare parts, is to be maintained at all the State training centres.

Last year the Commonwealth Government passed a measure to regulate and legalize air traffic. Machines, before being placed in commission for passenger services, are to undergo an inspection and test on the lines now familiar at home, while pilots have also to pass an examination in regard to qualification and physical fitness. The Civil Aviation Branch of the Defence Department has approved the establishment of aerial mail services between Sydney and Brisbane and Sydney and Adelaide. Tenders are being invited from private companies willing to undertake the work, while the Government has already accepted a tender for an air service between Geraldton and Derby, in Western Australia, a flying distance of 1,200 miles. All the services are to provide for both mails and passengers.

All this is very encouraging, showing as it does that the potentialities of aerial navigation are fully appreciated at the Antipodes. The beginnings are small, it is true, but all things must have a start. We think the Australian Government is to be very much congratulated upon its early enterprise. It is getting going in earnest, and as the Commonwealth is essentially a country in which aviation can do an enormous amount of good by opening up communications where none now exist, we look forward to very great developments within the next few years. Australia should be well in the front rank of commercial aviation before many years are past.—*Flight.*



How To Make a Scale to Measure Thrust

MODEL propellers should be tested to show just how many ounces of thrust the propeller is giving. In this way the poorer propellers can gradually be discarded when they are seen to give but little thrust by comparison with others. The selection is simplified by the home-made scale illustrated here.

By means of this scale, instant readings are shown in a way that should make it a part of every builder's outfit—it is simply hooked on to the rear of the model as it rests in position for flying, and when the propeller or propellers are released, the spring stretches to the various marks previously made on the scale. As there are but two wires and a spring required, the materials are not very elaborate. The tools required are a pair of pliers for bending the main rods, a hand drill and No. 60 drill for the two spring holes, a hammer to flatten three of the rod ends, and a file for marking the "scales" on the rods.

The sketch will be sufficient to show the arrangement, and the sizes and materials can vary according to those most available or desired. The suggested length, however, is not less than 8 inches overall. The spring can be two and one-quarter inches long, ⅛" in diameter. The spring may be of music wire No. 8 gage (American Steel & Wire Co's. gage) which is .020 diameter. Brass rod makes the best frame as it is easy to bend, flatten and drill; a diameter of 3/32" will do.

The spring can be formed by winding the steel wire around a ⅛" nail. This is best accomplished by turning the nail in a hand drill while the wire is fed onto it tightly.

First bend the rods with the hooks arranged so that the pull will be directly from the centers of hooks, and passing through the axis of the spring. This eliminates uneven working and the resultant inaccurate results. The flattened ends clamping around the rods should allow the rods to slide freely. Marks are left until last; they can be determined by weighing a 1 lb. weight.

When the zero and 1 lb. marks are found by weighing, the ounce marks are easily made by dividing the distance between the two original marks into 16 equal divisions, each one representing an ounce. In the same manner, marks can also be made on the sliding rod, to indicate the fractions of a pound by 4 ounces each or ¼ of a pound. Carefully placed lines are filed on the rods as the indicating marks.

As an example of how the spring stretches in proportion to its diameter and length, it was found that a spring of No. 8 steel, in a coil ⅛" in diameter and 1⅜" long stretches to 5" with a weight of 10 ounces. Some tests on model thrusts made with such a scale as this, originated by George Page, holder of many model records some years ago, showed that for the average rubber driven or compressed air driven model, the thrust should equal one-fourth of the weight of the model, or the model will be under-powered. A model weighing 1 lb. should have a thrust of not less than one-quarter of a pound, and so on.

Another feature which is brought out strongly is the manner in which the thrust drops off as the power is diminished. For the first few seconds the highest thrust is recorded, but the thrust very quickly drops at an increasing rate as the motor unwinds.

One very important point must not be overlooked, and that is to use a spring, which will stretch considerably with but little weight, for then the readings can be more accurately read. A hard, heavy, stiff spring will only move a short distance to record a full pound, and obviously the finer readings, such as ounces, cannot be observed at all.

Such a scale as this is also very handy to weigh up the parts of a model, for the ordinary small spring or balance scale does not show the weights in ounces.

Monoplane Wings

Principally on account of a number of accidents due to faulty designing, the monoplane has not been as widely used as it should have been. There are several important advantages inherent in this type of wing construction. Aerodynamically, a monoplane wing is much more efficient than a biplane or triplane wing.

From the standpoint of visibility a monoplane wing is excellent because there is no interference from the lower wing. If a pilot is so placed that his eye is on the level with the wing of a monoplane, his "blind angle", due to the wing interference, is very small.

Even an externally braced monoplane cellule is much easier to assemble and true up than a biplane cellule, while an internally braced monoplane wing offers no rigging difficulties whatever.

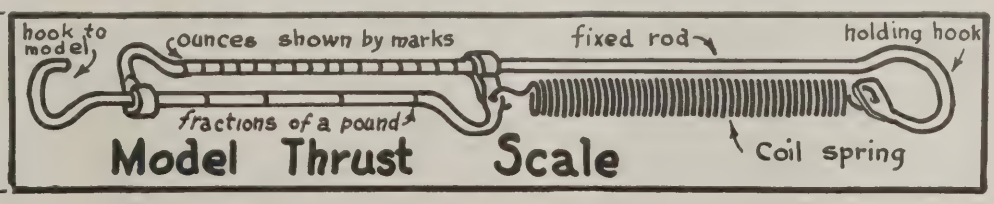
Monoplanes braced by complicated trussing are entirely obsolete. If external bracing is employed, it should consist of struts or wires from the front and rear spars to the bottom of the fuselage (like the Loening, for example). If struts are used, the reactions from a negative air load are carried by them in compression, and if the wings are braced by wires against the direct air loads only, then the spars, which must in this case be continuous over the fuselage, acting as cantilevers, carry in bending all negative loads.

A wing structure should have a factor of three to three and one-half under reversed load. If the design is well adapted to a wing with continuous spars, the wire type of bracing is satisfactory as it offers a minimum amount of air resistance.

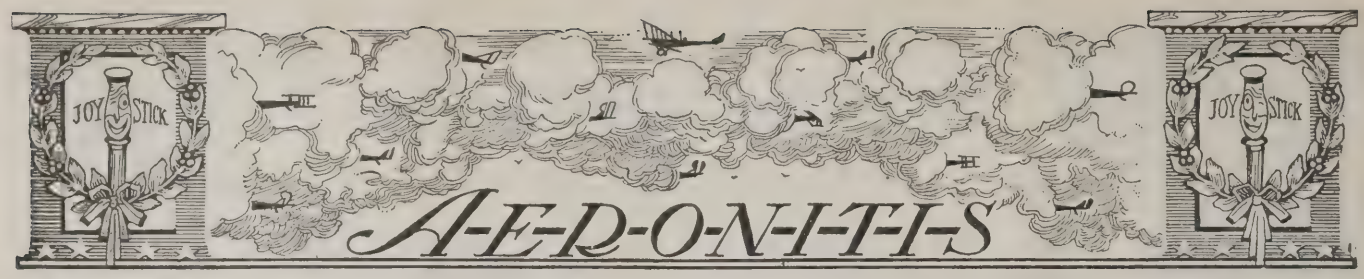
In comparing a wire braced wing with an internally braced one, it should be noted that the former type, when acting as a cantilever, has only about 40 percent of the load to carry that comes on the latter from the direct air load. For this reason, one of the thin wing sections might be used on a wire braced wing if the increased efficiency of the thin wing section is of greater importance.

For internally braced monoplanes, the U.S.A. 27 wing section is quite suitable, combining as it does, large spar depth, high lift and high efficiency. It will not prove as satisfactory on a strut braced cellule, however, as it is impossible to take full advantage of the spar depth afforded.

On a braced wing, incidence wires in the plane of the struts should be omitted, for if they are effective in carrying drag loads, they put such heavy secondary stresses in the struts that the latter fail long before their normal safety factor is reached. All drag should be taken care of by the internal drag trussing.



Sketch of the spring scale described above for measuring the thrust of propellers on model aeroplanes



At eight o'clock we had a drink;
At nine o'clock the world was pink;
At ten o'clock the blow did fall—
The whiskey was wood alcohol.—*The Log.*

Jack—"How does a sailor come home from a home-brew party?"
Straw—"I dunno."
Jack—"Souse by yeast."—*Phœnix.*

In Church

There was a lady named Anna,
Who sang in a clear high soprano:
The tenor declared, as she fell down the stirs,
"I have heard, now I see your hosanna!"

Lines to a Movie Vampire

I sing today the Vampire of the Movies,
  I sing of Sheeza Beara—and she is—
Whose architecture Doric
  Is a clutter of caloric
  As she vamps it in her transculent biz;
I love to see her zaz a bit in Zaza,
  She writhes, she lures, she palpitates, she quivahs!
You ask me has she got the stuff? She haza!
  She agitates me very lights and livahs!

  Them eyes of hern,
  Oh how they burn,
  Oh how they sparkle, snap and yearn!
  Them liquid coives,
  Oh how they swoives,
  Its pretty doggone hard on noives . . .
  She starts . . . she moves . . . she seems to feel
  The thrill of life along her keel . . .
  A rag, a bone and a hank of hair?
  What do I care?
  She's a bear! She's a bear! She's a bear,
    There!

I sing today the Vampire in the Movies,
  (Them eyes of hern!)
I tell you she's a regular Vesuvy.
  (Oh how they burn!)
Her agile architecture is conducive to conjecture,
  (Them sneaky coives!)
Oh lamp this lyric lecture 'fore her luscious lure has wrecked your
  Throbbing noives!
On yon Paphian piazza you just ought to see her zaza,
You just ought to see her, Yazza!
Has she got the stuff? Cazazza!
  But she haza! —*Froth*

Snuff!

—"Sneagle."
—"Snoteagle, snowl."
—"Sneither, snostrich."—*Burr.*

I gave her many kisses,
But still she cried for more,
And I couldn't give her any
For we'd passed the candy store.—*Juggler.*

Barber—"How do you like the new razor, sir?"
Victim—"I hardly knew I was being shaved."
Barber (flattered)—"Why, that's fine, sir; but what could you have imagined?"
Victim—"That I was being sandpapered."—*Virginia Reel.*

Rastus—"What fo' you all got yo' pants on wrong side out, niggah?"
Sambo—"'Cause Ah's goin' to de ball tonight and Ah wants to git de bag outer de knees."—*Orange Peel.*

Virginia had a little quart
  Of cider, hard as steel,
And everywhere she went 'twas sport
  To watch Virginia reel.
—*Gargoyle.*

Little beams of moonlight,
  Little hugs and kisses,
Make the little maiden
  Change her name to Mrs.
—*Medley.*

Recipe

First you take a cocktail shaker
  Then you add wood alcohol,
Neighbors call the undertaker.
  Pretty lilies. That is all.

American League Fan—"That woman's hose makes me think of a ball game."
Bushleaguer—"How come?"
A. L. F.—"One down and a runner on second for the Sox."

Fair Girl—"What was the row in class this morning?"
The Other—"I was slow in reciting, and the Prof. told me to shake a leg."
Fair One—"What of that?"
The Other—"Well, I shook a leg, and he excused me from recitation."

"Give Us Liberty or —"

May—"Why were you and George on the porch so long last night?"
Belle—"We were talking—on serious subjects."
May—"For instance?"
Belle—"O-o-o-o-h-h, The Freedom of the Press."

Iris—"Why does she want to marry that guy? His attic's empty."
Estelle—"True, but his cellar isn't."

Ain't Nature Wonderful?

One day as I chanced to pass
  A beaver was damming a river,
And a man who had run out of gas
  Was doing the same to his flivver.

First Listener at the Recital—"What do you think of his execution?"
Second ditto—"Long delayed—too long delayed."

Harry—"Newlywed died very suddenly."
Perry—"Yes, what ailed him?"
Harry—"His wife hit him with a biscuit when he complained about the food."
Perry—"That accounts for the inscription on his tombstone then."
Harry—"What's that?"
Perry—"Say it with Flours."

He—"I think that Jack is a good talker."
She, reminiscently—"Yes, he knows how to hold his audience."

She Couldn't Learn How

I knew a little co-ed, dears,
  Who's now a woman grown,
When I was introduced to her
  She stopped to roll her own.

In vain the sisters showed her how
  And did elastics loan,
But fifty times a day that child
  Must stop and roll her own.

When I pressed the fatal question
  She gave a little moan,
And before she answered, "Yes"—
  She bent and rolled her own.

And when she promised to obey,
  She said in lower tone,
Kind Sir, just pause a moment
  For—I want to roll my own!

AIR LAIRD PLANES WICHITA, KANSAS

The Laird Swallow
"America's First Commercial Airplane"

NOW $4,500 F. O. B. WICHITA, KAN.

INCREASED production enables us to announce this reduction, effective immediately. At this price the Laird Swallow will be the most wonderful buy in America today. Brand new in every detail—built in our own factory, powered with the OX5 motor, carrying three passengers with full load of fuel and baggage—magnificent in performance—remarkably low upkeep and operation costs.

Our new sales plan will be most interesting to every person interested in aviation. Write for details and booklet.

E. M. LAIRD COMPANY
Manufacturers
WICHITA, KANSAS
General Sales Offices
2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.,
2216 So. Michigan Ave., Chicago, Ill.
Please send me details of your new sales plan and copy of booklet.
Name .....
Address .....
.....
AA

Navy Has Catapult to Launch Planes

Washington. — Secretary Denby announced October 16 that, after much experimentation, the navy has developed a catapult for launching aeroplanes from battleships which will soon be tested. A complete catapult unit is now ready for installation on a battleship, and if the invention meets expectations in tests in service, the machine can be produced in quantity and all battleships of the fleet can be rapidly supplied with this new form of aviation equipment.

The catapult consists of a carriage moving on tracks. On this carriage is mounted the aeroplane. The carriage is caused to move on the tracks at an increasing speed until, near the end of the tracks, its speed is sufficient to permit the aeroplane to take the air. Then the carriage is brought to rest by means of suitable brakes and shock absorbers. The apparatus can be made in varying sizes so as to be adapted to the launching of any aircraft likely to be used from surface ships.

Normally, when an aeroplane takes off from the flying field, it runs along until it has attained a speed through the air sufficient to sustain it aloft. This is known as its minimum flying speed. After attaining such a speed on the ground, it can be so controlled as to take the air and to remain up so long as this minimum flying speed is maintained. The length of run necessary is dependent upon the type of plane concerned and its loading, the wind, and the nature of the terrain.

In case of a very lightly loaded plane, such as a single-seat plane, with a strong wind against the direction run, the length of run required before leaving the ground would be very short. However, as a rule, the length of run required is considerable, and under unfavorable conditions it may be several hundred feet. To supply this starting speed from the ships the catapult has been developed.

When a plane is launched from the deck of a battleship by means of a catapult it cannot land on the deck of the vessel at the end of the flight. Thus planes which will be used from battleships must possess some means of flotation. At the end of a successful flight they will alight on the water in the lee of the ship and be hoisted on board by cranes.

In the case of planes operated from proper aeroplane carriers, they may be launched by means of catapults from the carriers, or, under favorable circumstances, may take off directly from the flying deck of the carriers, as from a field. Also, at the end of their flight they may alight on the landing decks of the carriers, where they will be brought to rest gradually by the arresting devices now being developed.

In the absence of the catapult in recent efforts to launch aeroplanes from battleships platforms were built on the top of turrets and supported by the muzzles of the guns. The turret was so trained as to point the plane directly into the wind.

Under favorable conditions it was found possible to launch small light-loaded aircraft. The apparatus was heavy and cumbersome and interfered with the turret on which it was used. The plane was not locked to the platform while it was attaining flying speed, and a side gust was liable at any time to cause a serious accident.

The catapult will be built into the ship which is to use it and will be so installed as not to interfere with any other part of the vessel. It is believed in navy circles that in the near future all surface ships will be equipped with catapults and aircraft as they are now equipped with small boats. By a system of tracks the aeroplanes will be run from their hangars onto the upper decks of the surface ships and the carriages of the catapults.

Normally, while the ships are cruising or in bad weather, the planes will be kept under cover in the upper decks, some disassembled and some partially assembled. Up to the present, due to the fact that aircraft are of such recent development in use on ships, the apparatus necessary for them has not been "built in." Naval officers say the battleships of the future will be designed undoubtedly to take their catapults, necessary hangar space, machine shops, the tracks and their aircraft, just as they are now designed to take their turrets and guns.

Seaplane Landing at Lake Champlain

The Commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that a landing for seaplanes can be found at Burlington, Vt., on Lake Champlain, in any depth of water from 0 to 40 fathoms, sand bottom, with excellent beaching facilities.

Obstructions consist of breakwater, small boats, and a few fish stakes placed wide apart.

Landmarks. — Breakwater and lighthouse.

Supplies.—Gasoline, oil, and fresh water, but no plane supplies; garages.

Burlington is a good place to go with either land or sea planes; altitude should be about 4,000 feet. Follow the Hudson to Glens Falls, then jump over to Lake George; do not follow the canal. There is good water all the way except small stretches of the Hudson above Albany and 15 or 20 miles of land between Glens Falls and Lake George.

WING COVERING

Doping, Pigmenting, Enameling, Varnishing accurately, quickly and economically done

LINEN, LINEN TAPE, LINEN COVERS, DOPE

Grade A Linen—90c per yard
Grade A Cotton—50c per yard
Scalloped Cotton Tape—6c per yard

AVIATION MOTORS

Overhauled and Repaired by French Engineers
Rotary Engines a Specialty

G. VOISIN, Expert

20 Years of Practical Experience

Tel. 139 W. Hasb. Hgts. 236 Franklin Ave., Hasbrouck Heights, N. J.
Factory: 70-72 Rome St., Newark, N. J. Tel. Market 9170.

Aeroplane Cloth
Pinked Tape

All Widths
Grade A Mercerized
Immediate Delivery

F. C. BARTON, Mfr.
65 Worth St., New York, N. Y.

CANUCK

AND

OX5 ENGINE SPARE PARTS

IMMEDIATE DELIVERY

C. A. L. PROPS $15 PARAGON PROPS $30

ROME-TURNEY RADIATORS $20

Also Complete Assortment of Standard Utility Parts

Get Our Prices Before Ordering

AIRCRAFT MATERIALS & EQUIPT. CORP.
1409 SEDGWICK AVE. NEW YORK CITY

The Spark Plug That Cleans Itself

B-G

Contractors to the U. S. Army Air Service and the U. S. Navy

THE B. G. CORPORATION
33 Gold Street New York City, U. S. A.

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

PHILADELPHIA AERO-SERVICE CORPORATION
636 Real Estate Trust Bldg. Philadelphia

ECONOMY

IS NOT JUST A QUESTION OF LOW FIRST COST BUT ALSO

LONG SERVICE and RELIABILITY

USE

TITANINE

TRADE MARK

DOPES and COVERING MATERIALS

MADE BY

TITANINE Inc.
Morris & Elmwood Aves. Union, Union County, N. J.

L. P. WITHERUP

Mechanical Designing Engineer

Specialist on

Lubrication and Bearing Problems. I Make Your Own Bearings or Bushings Work Without Heating.

DESIGNING
DEVELOPMENT
DETAILS
DELIVERY
} of {
Internal Combustion Engines of any type, class or service. Airplanes to Farm Engines.
Invention Devices, Manufacturing, Air Compression, Pattern and Machine Work.

If you have a two-cycle engine giving you trouble or will not develop its full power, write me particulars and I will straighten it out.

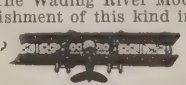
LOCK BOX 1472, CINCINNATI, OHIO

THE De Luxe Air Service, Inc., can store several machines for the winter at reasonable rates in its large hangar at Deal, N. J. It is also able to undertake repairs on Canucks or "D's", or furnish parts for these machines and OX5 or OXX motors at interesting figures. Get our new price list, or our quotations on any of above jobs.

DE LUXE AIR SERVICE, INC., Asbury Park, N. J.

Students of Aviation, Model Builders and Experimenters

The Wading River Model Airplane & Supply Co., as the oldest establishment of this kind in the U. S., is able to supply you with the best material at the most reasonable prices.



Scale Drawings and Blueprints of some of the latest types always on hand.

We also make models to your own plans at reasonable prices.
Send $.05 for Illustrated Catalog.

WADING RIVER MFG. CO., 672 Broadway, Brooklyn, N. Y.

AERIAL AGE WEEKLY

VOL. 14, No. 8 OCTOBER 31, 1921 10 CENTS A COPY

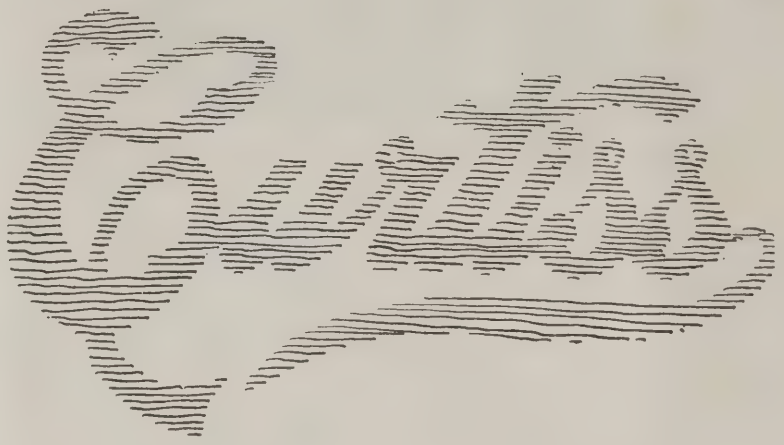
UNIVERSITY OF ILLINOIS NOV 1 1921



Airscape of Grant's Tomb, New York City, Photographed for the Fairchild Aerial Camera Corp., by W. L. Hamilton

Standardization in Aeroplane Design

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



A Further Reduction

APPROXIMATING 25%

in the price lists of parts

for

Orioles
O X Standards

Jennies
C 6 Standards

is announced

EFFECTIVE SEPTEMBER FIRST

Write for revised price lists.
Motor price lists are not affected in this reduction.

CURTISS
AEROPLANE AND MOTOR CORPORATION

GARDEN CITY **LONG ISLAND**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., October 31, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, OCTOBER 31, 1921 NO. 8

Standardization in Aeroplane Design

THE idea of standardization is usually associated with nuts, bolts, clevises, turnbuckles and other small parts. It is extremely important that all of these parts should be standardized—in fact, there could be no aeroplane production if this were not the case. However, most of the work of this character has been completed satisfactorily, though it is being extended to embrace more and more kinds of small parts, such as connections, and valves in fuel, oil and water systems.

The general principle of standardization can also be effectively applied to the semi-raw materials entering into aeroplane construction, such as steel and duralumin sheet, tubing, and structural shapes, and to plywood. In the case of tubing, for instance, manufacturers put out several hundred sizes which can be obtained in two or three grades of steel. To attempt to carry such assortment in stock is impossible. It is a great advantage to have both military and commercial aeroplanes designed from a comparatively limited list of tubing which could be kept in stock by even small repair depots. In production, matters are considerably simplified if the number of sizes of material handled is small.

The designer is not handicapped in structural work if he has only some sixty sizes of tubing, including both carbon and alloy steel, to choose from. Such a carefully selected list has been prepared and used with much success at McCook Field. In a similar manner much shorter lists of oval and streamline tubing and of U, channel and angle sections can be made up. The designer instead of using any odd size would select a suitable section from these lists. Owing to the newness of metal construction in aeroplane design, the number of such sections available is small. New dies or rolls are required to manufacture sections not on hand, which makes the use of many different sizes prohibitive because of cost.

Plywood is another material which designers in the past have been at no pains to standardize as to total thickness, ply thickness, and combination of plies or woods used. It has been impossible for manufacturers to keep a sufficient variety of plywood in stock to supply the varied calls of designers. To get the best results from plywood requires careful design. In general, it is much better to select a plywood from such a table as has been prepared by McCook Field than to design it. In this table the entire range in thicknesses from 1/16 to 1 in. has been covered by the use of only five ply thicknesses in various combinations, chosen to give the proper ratio of core to total thickness.

Three general principles should be borne in mind in all standardization work. First, what is selected as a standard must be commercially available. Second, the lists of sizes should be just as small as it can be made without handicapping the designers. Third, those sizes and shapes which are standardized should be the most efficient. B.C.B.

[The tables and lists mentioned will be published in AERIAL AGE in the near future.]

New Theory of the Slotted Wing

IN a paper recently read before the Society for Aeronautical Science at Munich, Dr. Betz dealt with a certain development in sustaining planes or aircraft wings due to Lachmann in Germany and Handley Page in England. The object is to increase the lift by providing slots in the wing parallel to the leading edge. If these are to be effective they must extend without interruption across the entire width of the wing. This arrangement may also be regarded as an extra plane of small depth placed in front of the main wing at its leading edge so that there is only a very small space left between the two. The maximum lift of the plane is thereby increased by 80 per cent or more. There are different explanations of this phenomenon. One is that the small plane located in front of the main plane is located in an air stream whose conditions of flow are determined by the main wing. It follows that at the leading edge of the main wing the air speed materially exceeds the speed of flying. The reactions of the air on the small wing in front therefore are considerably greater than if it passed through space at the flying speed.

The new explanation of Dr. Betz is based on the fact that for a given speed the lift of a plane increases with the angle of incidence until the air stream on the upper surface can no longer follow that surface. If the angle of incidence becomes too big, a new condition of flow develops, the air stream separating from the plane, creating a field of eddies which grows with the angle of incidence. Such eddies have a tendency to form even in the case of small angles of incidence, but the air, passing over the plane, immediately washes them away, and thus maintains a smooth, lift-creating stream. In the case of large angles of incidence this becomes impossible. But if the air stream on top of the plane is reinforced by air passing through the slot in the wing from the under to the upper side, the lift-creating flow conditions can be maintained even with larger angles of incidence. New energy is being supplied to the air stream on top of the plane by the air flowing through the slot, which enables it to continue to wash away the eddies. This energy has to be paid for, however, the phenomenon being accompanied by increased drift of the slotted plane as compared with a plane without slot.

This new explanation is valuable for the reason that it furnishes a basis for judging the value of new plane combinations of the kind referred to, and facilitates the arrangement of systematic test series in a field where the number of possible combinations is almost without limit.

—*Automotive Industries.*



The News of the Week



Aeroplanes and the Railroad Strike

In view of the threatened railroad strike, the Manufacturers Aircraft Association on October 17 telegraphed to Secretary of Commerce Hoover a report on the aircraft available for emergency transportation:

"There are at least 750 commercial aircraft immediately available for the general carariage of passengers, mail and express. They are of both land and water, cargo and passenger types. Fifty are in commission in the vicinity of New York. Others in proportion are available out of Boston, Philadelphia, Baltimore, Key West, New Orleans, Kansas City, Dayton, O., Cleveland, O., Chicago, Buffalo, Minneapolis, points in Texas, Los Angeles, San Francisco and Seattle. The aircraft carry from two people, or the equivalent in weight to eleven or twelve, and have a non-stop range of flight from 200 to 800 miles. Arrangements must be made for fuel and service, and advise that municipalities that wish to avail themselves of aerial transportation, place their airports in condition."

The offer to Secretary Hoover was based upon reports now being received by the Association from operators in all parts of the United States. These reports show that there are probably 1,200 commercial aircraft stationed in every part of the country, but it is thought only about two-thirds of these are suitable and available for cross-country flying.

The fifty or more planes in Greater New York are in commission on the various fields on Long Island and New Jersey.

The Aeromarine Plane and Motor Company offers six eleven-pasenger flying boats, twelve six-passenger and five three-passenger, available at Keyport, N. J. and Key West, Fla.

The Curtiss Aeroplane and Motor Corp. has twenty, two and three-place land machines ready at Garden City and reports that their depots in all parts of the country, have several hundred more of similar types tuned up for flight.

The Loening Aeronautical Engineering Corp., whose Flying Yacht has recently been operating between New York and New London at less cost than the cost by rail, is ready for Boston, Philadelphia or Washington service.

Lawrence Sperry has in commission his five-passenger high-lift wing Curtiss J. N. monoplane, the Messenger and a score of Avros.

The Wittemann Aircraft Corp. of Hasbrouck Heights, N. J., reports four land planes. The Wittemann company today received telephone instructions from the Post Office Department to rush completion of five DeHavilands for the Air Mail. These DeHavilands can carry six or seven passengers or 800 pounds of bulky mail.

John M. Larsen has five J. L. monoplanes at Central Park, L. I., each carrying six people. These planes are to leave shortly for the middle west, but will be available in Kansas City or Omaha or can be recalled to New York or sent wherever needed.

At Curtiss Field on Long Island there are three or four five-passenger S. V. A. land planes of the Aero Import Corp. and two Fokkers of the Netherlands Aircraft Co., one carrying five passengers. These ships are already in service.

Reports from over the country state that the Thomas Morse Company at Ithaca, the Glenn L. Martin Company at Cleveland, G. Elias & Bro. at Buffalo, the Dayton Wright Company at Dayton, O., and the Boeing Airplane Company at Seattle are ready to provide services and wherever possible to put more machines in the air. The Dayton Wright Company has three long range cruisers, one of which carries four passengers, and which is in frequent operation between cities of the middle west. Two lines, one land and one water, operate in conjunction with the Boeing Company out of Seattle. The seaplane line connects with Victoria, B. C.

Particularly extensive service can be provided out of Kokomo, Ind., where there is a large air-port with fifteen or twenty machines, Minneapolis with twenty-five or thirty, and San Francisco and Los Angeles. In the two latter cities the California-Curtiss Company, the Mercury Aviation Company and the Rogers Airport have available a hundred planes of various types.

Aerial transportation will fill the demand for the urgent movement of negotiable banking paper, checks, etc., clearing of which will relieve the financial system; it will meet to a great degree the problem of carrying the mails. The Air Mail, now operated only between New York and San Francisco, has contact between New York and the South by way of Washington and could, if advisable, operate two more lines between New York and Chicago, taking in Pittsburgh, Ft. Wayne, etc. The equipment exists and the route is charted between the Twin Cities and St. Louis. Air travel is so common on the Pacific Coast that movement of the mails by aeroplane between San Francisco and Los Angeles is practicable at once. The Seattle-Victoria mail could be extended south to Portland and east to Spokane and Minneapolis.

The same type of aeroplanes capable of carrying the mails can also transport limited quantities of food, but it is believed that the greatest service will be in providing service to government officials or business men on whose travel from point to point may depend the working out of other problems, such as motor transport or the increased utilization of the water ways.

Although no united national effort has been made, airways have been laid out over most of the United States, and there are enough of the seventeen thousand pilots in training to man the ships available.

Fly Battle Plane Mounting 30 Guns

An armored military aeroplane mounted with thirty machine guns capable of spraying 3,000 shots in four minutes has been completed by John M. Larsen, an engineer and inventor, at his aeronautical plant at Central Park, L. I. Carrying Larsen, Brook Hyde-Pierson, pilot, and M. Goodenough, mechanician, the craft will fly to Washington to be inspected by army and navy officials.

The J-L attack plane, as it has been named, is of all-metal construction and has a cruising speed of 141 miles an hour. It has a wing spread of 49 feet and a length over all of 32 feet. A 400 horse-power Liberty motor supplies the power. Its radius of action is 400 miles.

The craft is a monoplane with cantilever wings which do not require exterior bracing. When manned with crew and equipped with 3,000 pounds of ammunition and necessary fuel the plane weighs 5,000 pounds.

Larsen places great stress on the maneuver ability of the plane, which, despite its size and bulk, can be manipulated as easily as the single seater, he says. It can be put through aerial maneuvers such as the loop-the-loop, the Immelmann turn and the like, he declares.

The main battery of armaments consists of twenty-eight machine guns arranged in two sections inside the body. The first section of twelve guns is placed back of the pilot's seat, sixteen other guns are mounted to the rear. The remaining two guns are superimposed on the forward part of the cockpit, where they may be operated by the pilot and a gunner.

The two main batteries of guns are fired by means of three levers, two of them each firing a section and the third, a master lever, exploding the whole twenty-eight. Each gun has been tested to fire 1,500 rounds per minute. It requires only four minutes to replace fresh magazines in all the guns.

Each of the circular drums used in the Thompson machine guns on the plane contains 100 cartridges. The ammunition equipment consists of three drums each for the thirty guns, a total of 9,000 cartridges.

A particular feature of the plane is the armored protection afforded to vulnerable parts. The plane itself is constructed of duralumin, an alloy of alluminium, the metal sheets having a thickness of 25/1,000 of an inch. Vital parts are braced with armor 3/16 of an inch thick, sufficiently strong to deflect both rifle and machine gun bullets, it was said.

Third Armistice Dinner

Reservations from all over the country are being received by the Armistice Dinner Committee of the Aero Club of America and many of the old squadrons are engaging special tables. Last year the 90th, 27th and others made wonderful records in getting their old gangs together, and already this year former members of these squadrons have assured Colonel Hartney, Executive Secretary of the Aero Club of America, their representation will be larger and better organized than ever before. The dinner will be held at the Hotel Pennsylvania.

New England's First Air Mail Delivered

Framingham, Mass.—What was said to be the first aerial mail delivery ever made in New England was completed October 23, when Lieut. R. C. Mossat arrived from Washington by aeroplane with a pouch of letters for Boston and vicinity.

Included in the mail were letters from President Harding, Vice-President Coolidge and Senator Lodge.

LONGEST SEAPLANE FLIGHT

By W. W. WYMAN

THE Aeromarine flying boat Santa Maria has just completed the longest trip ever attempted on this continent by a ship of its kind. This trip of about 8,000 miles was accomplished without accident of any kind to ship or its occupants. It was also made with the hearty co-operation of the United States Navy with the idea and purpose of stimulating civilian interest in aviation, and from this standpoint it was a complete success.

The Santa Maria started from its home at Key West, Florida, where in the winter months it is in regular service carrying passengers and mail between Key West and Havana, Cuba. It flew up the Atlantic Coast to New York City; up the Hudson River, along Lake George, Lake Champlain and the St. Lawrence River to Montreal, thence completely around the Great Lakes to Chicago.

The Santa Maria arrived in Chicago one minute ahead of schedule to take part for two weeks in Chicago's Pageant of Progress, where hundreds took flights in her and were convinced of the comfort and safety of this future mode of travel.

From Chicago the great Santa Maria, which never flies beyond gliding distance to water, wended its way down the Illinois and Mississippi Rivers to New Orleans, from where it followed the eastern shore of the Gulf of Mexico to Key West, completing as history making a trip as the boat, after which it is named, on which Columbus came to this country.

The Santa Maria alighted at prominent cities and towns every two or three hundred miles to obtain gasoline and oil and spent a day or two to carry passengers, as this is the most effective method of convincing the public of the safety and comfort experienced in air travel. We know that without exception every one of the thousands that rode in the Santa Maria were not only pleased, but very enthusiastic about this new method of transportation. We also know that they will spread their enthusiasm to thousands in their respective communities, thus accomplishing the object for which this trip was made. In some places we carried the same party on two or three flights and at several points we carried public officials and prominent business men to the next city on our route.

Many of our passengers had flown in two-passenger land planes, and they said the difference in the riding qualities between these planes and the seven-and-a-half ton fourteen-passenger Santa Maria was about the same as the difference in riding qualities of a Ford and a Locomobile.

All were also convinced of the superior safety of seaplanes, realizing the fact that a seaplane operated with proper conservatism always had a perfect landing surface under it. Both its motors could have stopped dead at any instant and the Santa Maria would have made a perfect landing on the surface of water, which is always level and soft.

Mr. C. F. Redden, President of The Aeromarine Airways, Inc., which owns the Santa Maria, had heard of the wonderful results obtained by the use of Lakeside Aviation Oil in the Army Air Service and he desired to see if he could obtain the same results in the Santa Maria, which is a converted Navy F-5-L Seaplane. So he arranged by telegraph with W. W. Wyman, who has charge of the Aviation Sales and Service Department of the C. L. Maguire Petroleum Company, to have sufficient supply of Lakeside Aviation Oil shipped to each stopping place of the Santa Maria between Chicago and New Orleans. Mr. Wyman, the writer, joined the Santa Maria at Peoria, Ill., and continued with her to New Orleans. The impression and notes of the writer follow:

The most interesting incident occurred about fifty miles south of Peoria. We were flying about 1,500 feet above the river when we passed three separate rainstorms. They were all only a few miles west of us. The central storm was coming from a long, narrow, low-hanging cloud that was very black. This cloud was not much higher than we were and we could see the water pouring over the western edge of this cloud in great streams just like water over a precipice. These streams spread out as they fell and by the time the earth was reached it was like ordinary rain.

We were scheduled to stop at Beardstown, Ill., but when we arrived, there was a stiff wind blowing across the river, which was not very wide, so we kept on until we found a town where the river and wind were going in the same direction. This was Naples, Ill. The only sleeping quarters there were in the only brick building, which was a combination general store, restaurant and hotel. There were six of us, and the best this "hotel" could offer was one room with two double beds. So two of us chartered a Henry and drove to the next town, five miles away, and found a place to try to sleep.

The next morning we hopped back to Beardstown in twenty minutes and filled our engagement. Our reception by Beardstown was all the more cordial because of the disappointment of seeing us fly right by the night before.

At Cairo, Illinois, which is called the little Egypt of this country, the owner of a large store chartered the Santa Maria, taking six of his friends for a half hour's poker game among the clouds—they all won, because all so greatly enjoyed the novelty.

Congressman F. C. Hicks, Chairman of the House Committee on Naval Aviation, joined the Santa Maria at Cairo, Illinois, and continued with her to New Orleans. He made himself one of the "boys" of the party and added to the enjoyment of all. Chamber of Commerce officials buttonholed him at all points and filled his ear with their ideas of what Congress ought to do for their particular district. Mr. Hicks, who represents in Congress the late Col. Roosevelt's home district on Long Island, enjoyed the trip and was observing to add to his fund of knowledge about Naval Aviation. He met and was cordially entertained by several Congressmen who sit on the other side of the House, and delivered many interesting talks at Rotary Clubs and Chambers of Commerce luncheons.

When we arrived at each place we invited the Mayor, officials of the Chamber of Commerce and Reception Committee to take a flight over their town. When we extended this invitation to Mayor Kiel of St. Louis, we found that he had had a hundred invitations to fly, which he had consistently refused. But after he talked with friends who had flown in the Santa Maria, he not only went for a trip himself, but took his son and daughter with him. When the Mayor came ashore he said he felt as safe and as comfortable in the Santa Maria as he did in his automobile.

On account of unforeseen conditions on the way to Baton Rouge we came down on the river near the settlement called Tunica, in Louisiana, and as it was nearly dark we decided to spend the night there.

It did not look very inviting, for we could see only a few cabins and no white people. We secured a boat to take our party of seven ashore and found a few white people who had come down to see what was up. On inquiry, we found a boy of 14 who said he knew a farmhouse where the school teacher boarded, and he thought Mrs. Jeffries would give us some supper and find a place for us to sleep. The boy said it was only about half a mile to this farmhouse, but I'm sure we walked three miles over dusty roads and across fields in the pitch dark. The only lights in the town were oil lamps in the cabins.

We were reluctant to ask for food and lodging for seven at one house, so we asked Congressman Hicks to knock on the door and do the talking and not forget to tell them who he was, as we knew they would feel honored to have a New York Congressman stop with them. The other six of us got in on the Congressman's coattails and all had the best "chow" we had had for weeks. We can all speak highly of southern hospitality. Six of us slept in one room. I was a long time getting asleep, but then slept well. The others said I slept very well, but that they all awoke as soon as I went to sleep.

We had a safe trip to Baton Rouge the next morning, when we took Gov. Parker of Louisiana with us to New Orleans. The Governor made a very congenial passenger and enjoyed the trip immensely.

Well, I was having such a good time living over this trip I nearly forgot to tell the results of the object of my trip.

The air temperature between Helena, Ark., and New Orleans averaged over 100 deg. Fahr. This hot weather and the poor quality, low gravity gasoline we had to use caused the engines to overheat, which made very exacting conditions for any lubricating oil to meet.

Lakeside Aviation Oil maintained its pressure and temperature throughout all these strenuous operating conditions and proved to all aboard the truth of our slogans—"Laughs at Heat"—"Costs less per flying hour." The average consumption of Lakeside was only 48% as much as that of the best oil the Santa Maria had previously used. Mr. Redden now *knows* the good things he heard about it.

During this trip the Santa Maria carried passengers from the age of two years to the age of eighty-four years, and all expressed the same desire—to always travel in the air. We carried more women passengers than men—wonder why?

Herring Spotting

Washington—Having begun investigation of the habits of the eel, British authorities are now devoting their attention to the elusive North Sea herring. Squadrons of seaplanes are employed to locate missing schools and advise British fishermen where they may be found.

A report from the office of the American Trade Commissioner in London says lack of herring has caused serious alarm on the east coast of England. Besides the seaplanes a special boat has been sent out from Lowestoft, the center or the British herring fisheries, to make a survey.



London-Paris Line to Fly All Winter

Through special efforts by the Air Ministry, British participation in the London-Paris air service is assured for the winter months by an extension of the present temporary subsidy arrangements. Many interested parties declare, however, that the arrangements are inequitable and expensive, and they even seek a revamping of the permanent scheme, which goes into effect next spring, on the basis of recent developments, which seem to make possible a profitable operation of the air route almost without a subsidy.

The scheme proposed involves the Air Ministry permitting approved firms to use Government aeroplanes, paying 2½ per cent. of the initial cost monthly for thirty months, thus acquiring the aeroplanes at 75 per cent. of their cost and on easy payments. There is a further subsidy of £3 for every passenger carried.

Against these subsidy figures Geoffrey de Haviland says his present aeroplane can carry five tons net cargo one mile on one gallon of gasoline and make a speed of 120 miles an hour. He places the initial cost of such a flying machine at £6,000 and its earning capacity at between £150 and £200 a day. He figures the depreciation of the aeroplanes at 20 per cent.

Types just appearing do even better than this. Holt Thomas, founder of the first Paris-London line, says the present DH-18 can carry a ton of freight 100 miles an hour and, "including interest and all charges, carry freight to Paris at a cost of sixpence a pound for a full load and a shilling a pound for a half load."

During the air congress a year ago there were demonstrated two types of flying machines that had been available for more than two years and could carry cargo for three shillings and nine pence and three shillings and seven pence, respectively, a ton a mile. It is now charged that few of these economic types of aeroplanes are in the service of the two companies to which the £50,000 is allotted for seven months just closing in order to meet the subsidized French competition, which prefers to employ obsolete and costly types.

Although it is charged that reliance on this subsidy prevented the use of better types of aeroplanes, enabling the Government to withdraw the subsidy, records of the great Handon airdrome show that the two companies operated during a brilliantly successful season from the viewpoint of efficiency and safety. Thousands more passengers were carried this year than last, of whom at least 50 per cent. were Americans, and there was not a single serious accident throughout the season.

Spring promises to be even better with newer flying machines under a new subsidy scheme and more extended and more frequent service to Paris, Brussels and Amsterdam.

Air Ministry Delegates

Included in Britain's delegation to the Disarmament Conference are the following representatives of the Air Ministry: Air Vice Marshal J. F. A. Higgins, Group Captain J. A. Chamier, Flight Lieut. A. R. Arnold, Flight Lieut. R. Gambier Parry and Mr. W. E. Taylor.

Pioneer Instrument Company

The Pioneer Instrument Co. is doing some very interesting work in the development of aircraft instruments. The partners in the concern are M. M. Titterington, B. H. Goldsborough and Charles H. Colvin.

Mr. Titterington has been closely connected with aircraft matters since 1912, when he built and flew his own plane. Since that time he was connected with the Curtiss Co. and the Sperry Gyroscope Co.

Mr. Goldsborough is in charge of the factory and his experience includes, besides his early shop training, a year of balloon work, eight years in the Navy and three years with the Sperry Gyroscope Co. as installation and test engineer and later as factory manager.

Mr. Colvin's connection with the aircraft industry began in 1913 with the Curtiss Companies in Hammondsport. Since 1914 he has been active in design, test, production and sale of aircraft instruments.

Proposed Inter-Island Air Service for Hawaii

That an inter-island aeroplane mail and passenger service may become a reality was indicated by a letter received recently by the Honolulu Chamber of Commerce from Mr. C. A. Webb of San Francisco, who asked for particulars regarding the possibility of establishing an aerial line between the islands. The line would handle mail and papers, with a few passengers. According to Mr. Webb, he would use 6-passenger flying boats.

Hartford Seaplane Landing

The commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that a landing for seaplanes can be found at Hartford, Conn., in 12 to 14 feet of water, mud bottom, with good beaching facilities; rise and fall of tide 1.4 feet.

Landmarks.—Hartford Travelers Tower, 507 feet.

Supplies of all kinds may be obtained at the Hartford Aviation Field, 2 miles southward of the city.

Sport Farman to Kansas City

The Sport Farman will make its first appearance in the Middle West at the American Legion Flying Meet in Kansas City, November 1st, 2nd and 3rd, where it is entered in four events. The pilot will be Capt. D. H. Robertson. W. Wallace Kellett, representative of the Farman interests in America, with offices at 717 Widener Bldg., Philadelphia, will also be at Kansas City.

Aerial Fire Fighters

Fire fighting by aeroplane is the latest suggestion which is being studied by the Paris Fire Department following the burning of the Magasin au Printemps department store, with a loss of 40,000,000 francs. According to aviators who have proposed the scheme, it will be possible to control any fire within a few minutes with a minimum loss.

Instead of using water and pumps, however, the aviators would be provided with huge bombs which would explode on striking the burning buildings, filling the atmosphere with a gas that would completely choke the flames while being absolutely harmless to the people in neighboring buildings. It is estimated that one aeroplane could carry enough bombs to extinguish a blazing building.

The city's experts, however, are expressing doubt as to the feasibility of the plan, declaring that the air currents set up by the burning buildings would interfere with the aeroplane pilots to such an extent that it would be impossible to drop the bombs on the proper targets, although proponents of the scheme declare that this could be easily overcome by dropping the bombs from a height of a thousand yards.

Experiments will be carried on in the suburbs shortly with a view to ascertaining whether aeroplanes will be made an important feature of every well regulated fire company.

Use of Flying Boat Fleet Offered City

C. F. Redden, president of the Aeromarine Airways, Inc., sent word to Governor Miller and Dock Commissioner Murray Hulbert offering his fleet of flying boats free to the state and city in the event of a railroad strike. The following reply was received by Mr. Redden from the mayor:

"Dock Commissionr Hulbert has submitted to me your letter of October 17 offering in behalf of the Aeromarine Airways to place at the service of the city its entire fleet of aeromarine navy flying boats for use in case of possible emergency arising from the threatened railroad strike. Please accept my very best thanks for placing at the disposal of the city such modern commercial facilities.

"While I earnestly hope that no exigency may arise which will necessitate the employment of this flying boat service, I wish to take this opportunity not only to thank you but also to assure you that your praiseworthy public spiritedness is deeply appreciated."

Lieut. Bartlett Weds

Announcement has just been received of the marriage of Miss Sara Leathers, of Orviston, Pa., to Lieutenant Frank M. Bartlett, Air Service, U. S. Army, on October 5th. Congratulations and best wishes to the happy couple.

Lieutenant Bartlett, who is one of the best-known pilots in the Air Service, is a native of Port Townsend, Washington. He enlisted in the Aviation Section, Signal Reserve Corps, in May, 1917, passed his R.M.A. test on October 6th, and was commissioned a 1st Lieutenant on October 25, 1917. He was promoted to the grade of Captain on August 23, 1917. He performed excellent work as flying instructor both at Kelly Field and Carlstrom Field, acting as Officer in Charge of Flying at both of these stations. He also served two tours of staff duty in the Office of the Chief of Air Service, Washington, D. C. On July 1, 1920, he was commissioned a 1st lieutenant in the Air Service, Regular Army.

Lieutenant Bartlett is now under orders for a tour of duty in the Philippines.

DALLAS ORGANIZES AERIAL POLICE

MORE than 2,000 Dallasites gathered on the aviation field at the west end of the Oak Cliff viaduct to witness the swearing in and flights of the newly organized members of the aeroplane branch of the auxiliary police force.

Just before the Commissioner of Fire and Police Louis Turley, attended by Chief of Police Elmo Stralt and Chief of the Auxiliary Police W. C. Rice and surrounded by the Board of Commissioners, delivered the oath of office to the pilots, Dudley Mayer climbed into the front seat of his ship, Mayor Sawnie Aldredge stepping into the rear.

The Mayor's ship, the first to leave the field, went skimming across the open space and gracefully rose with a long, dipping sweep. Away over Oak Cliff, out across Trinity Heights, then back across the Trinity River, the sailing boat passed beyond view. To the ends of White Rock, over Highland Park, then the Mayor again was within range of the vision of the field. With a long, low dive the airship came within 200 feet of the earth, then rose steadily, mounting higher up until an altitude of about 1,000 feet was reached, from where it turned and dived almost directly to the field, striking the ground with a gentle bump, slipping along until it came to a stop at the edge of the crowd.

The first remark of Mayor Aldredge was: "Wonderful, truly wonderful! To get a real view of the magnificence of Dallas, one must see it from the sky. It is almost beyond description. Please let me tell first of my special admiration of my pilot. He certainly understands this boat. I thank him and appreciate the courtesy. As its Mayor, I can truthfully say Dallas is a wonderfully beautiful city. I am glad I went. It did not make me sick nor was I at all fearful."

The pilots of the ten airships lined across the field were then called before the Commissioners and instructed as to their new duties. They were directed to take five ships into the air and catch a "pirate" or "bootlegging" plane that had been seen hovering over the city. Using the V-formation, the vessels rose in order and after reaching the proper altitude, assumed the correct formation and sailed out in quest of the "bandit" boat. Then a sixth one was seen riding easily in the clouds, evidently watching an opportunity to alight in some secluded distant field. Immediately, following signals from the earth, the five ships turned and darted in different directions, closing in from all sides upon the "pirate" ship, forcing it to the ground, all six landing just on the edge of the crowd.

Alighting from the planes, the passengers were recognized as newspaper men representing each of the Dallas papers.

Augmenting the three planes stationed at the Ook Cliff aviation field, seven came over from Love Field and participated in the program. The first to arrive was that piloted by H. W. McGraw, with his wife as passenger. Lieutenant C. H. Howard, with Jeff Still, mechanician, followed closely behind, in a Standard. This machine at first looked like a mere speck in the sky, its altitude registering a little over 6,000 feet. Captain S. C. Coon, in a JN-SC or Canadian training plane, was the next arrival. He was followed shortly by H. C. Foster, with Dillard Hamilton as mechanician; J. L. Schroeder and G. G Lamkin in a JN-4D Curtiss; R. W. Vollum, piloting a Curtiss SW, with Major W. B. Atwell as passenger, and J. L. Moran in a JN-4C, with Jack Killingsworth as mechanician.



Mayor Sawnie Aldredge of Dallas

Chief of the Auxiliary Police W. C. Rice expressed gratification over the showing of the new branch of the auxiliary force. He said:

"The capture of the 'pirate' air boat was so realistic that it encourages us to the belief that hereafter when Dallas might be threatened from the sky or the regular police require the services of airmen, our men will not only be prompt in answering the emergency call, but will be able to cope with the situation. Aeroplane work has long appealed to me as being a needy service for police work.

"I feel sure the pilots will render a good account of themselves and even in the cases of stolen automobiles, it is not beyond the possibility that our airships can detect the criminals, particularly those fellows who steal cars and take them to lonely spots and strip them. They can be seen from the skies and the police notified of their location."

Mayor Aldredge also expressed gratification with the work of the air service of the police department, saying:

"Now we have a class of men at our disposal that will render criminal work much more difficult to get away with. I congratulate Chief Rice, I thank the men for their loyalty and willingness to aid in keeping our beautiful city free of crime."

Commissioner Turley and Chief of Police Strait left the field early because of duties elsewhere, but before their departure called the pilots and their assistants before them and commended them in glowing terms for their work. Mr. Turley told the pilots that badges signifying their membership in the auxiliary air service will be furnished them within the next few days.

While the planes were gliding through various formations and performing stunts over the city, Chief of the Fire and Police Signal System, Henry Garrett, flashed out wireless signals to the pilots from his automobile wireless station on the field below.



Lineup of Planes and Aerial Police Reserve of Dallas

ACCIDENTS IN COMMERCIAL AVIATION

A report prepared for the Secretary of Commerce by the Information Department of the Manufacturers' Aircraft Association states that, based upon the most trustworthy available information, it is estimated that 1200 aircraft are engaged in commercial flying in the United States today. A conservative estimate places the mileage flown by these craft during the period, January 1 to June 30, 1921, at 3,250,000 miles.

In the first six months of 1921 there were 40 serious accidents in civil flying, not including accidents to government-owned machines, resulting in death to 14 persons and injury, more or less serious, to 52. In 18 instances there were no casualties. The 14 lives were lost in 10 accidents, and injury to the 52 was caused in 20 accidents. The report gives the following requisite for safe flying:

1. A machine sound, aerodynamically and structurally.
2. An engine of sufficient power and which operates satisfactorily.
3. A competent, conservative pilot and navigator.

4. Air ports and emergency landing fields, sufficiently close together to insure gliding to safety.

5. Nation-wide weather forecasts specialized and adapted to the needs of fliers.

6. Nation-wide chart of air routes.

Each of the 40 accidents recorded was caused by deficiency in one or more of the above elements. Seventeen were attributed to the pilot, perhaps through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class craft. Therefore, at the very top of the list of government needs is placed the examination and licensing of pilots. During the war rather more than 17,000 young men were trained to fly. The art of flying can not be retained perpetually without practise, nor can it be maintained at a high degree of competency without regular examination. Ten accidents are attributed to inadequate landing fields or to the total lack of landing facilities. During the war the Army and the Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the Air Mail, municipalities and private enterprise, but the United States is today wofully lacking in air ports for even the 1,200 craft in operation. A survey made by the Manufacturers' Aircraft Association discloses that in the United States and its possessions there are only 271 land and water air terminals, many of which are concentrated in certain localities. Of the 271 listed air ports, 145 are controlled by municipalities, 69 are privately owned, and the others are a part of the Army and Navy air services, and the Air Mail.

While only two accidents are attributed to the lack of weather reports and two to the lack of clearly defined routes or limitations in travelling between or over cities, it is certain that aerial transport can not develop until these factors are met. As an illustration, two of the worst accidents in our flying history are attributed to these causes. As one was naval and the other military, they cannot be included in the civil table, although in their results they were as harmful to civil flying prospects as though they had occurred to private individuals.

Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the forty accidents, eleven may be attributed to faults which proper inspection probably would have revealed—three concerning the plane, six the engine and two an accessory. In many instances it is found that the engine is blamed when really it is an accessory that is at fault. An analysis of the Pulitzer Race last year proved this. When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that *anyone* can take *any* sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons below.

Eight of the forty accidents occurred during stunting. In these eight accidents seven persons were killed and twenty-six injured—exactly 50% of the total. In other words, stunt flying in unrestricted areas was responsible for as many casualties as all other elements combined. While stunt flying is necessary to testing and essential to warfare—and it is believed advisable that all pilots know how to stunt so that in case of an emergency, when only a stunt will save their craft, they will be able to act quickly, with understanding and without fear—the habit of stunting for thrill is dangerous, fatal in many instances and always harmful to civil flying. A government system of control, limiting stunting to certain areas will meet this unfortunate menace to aeronautics.

The danger of collision in the air is not great, providing levels of flight for aircraft under way are established and observed, and providing stunting is controlled. The only collision reported occurred during a stunt performance which resulted fatally.

Two accidents are reported through carelessness on the field. In one notable instance the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. This is illustrated by the long list of automobile race track casualties, where spectators got in the way. Only federal rules rigidly enforced are able to meet this condition.

Finally, five accidents are attributed to "unknown" causes. The hope of preventing accidents depends on learning—then correcting—the cause of each. It is evident government authority is required to obtain information in such cases.

FLIGHT ROUND THE WORLD

IN an interesting article in the London *Observer*, Major C. C. Turner discusses round-the-world flight, as follows: At least two British projects for flying round the world have been under consideration for some time, and it is certain that attempts will be made in the course of the next few months. In the main, such attempts will belong to the domain of adventure, and will throw little light on flight problems. No doubt success would be highly creditable for any particular type of aeroplane, but more interesting will be the selection of the route with reference to seasons and prevailing winds, and the skill in navigation displayed.

One of the first questions to be decided by these expeditions is whether the circuit of the planet shall be from west to east or from east to west. Sir Ross Smith, who will fly a two-engine Vickers-Napier amphibian, and will be accompanied by his brother and Sergeant Bennett (who were with him on his flight to Australia), has decided in favor of the west-east way, and for this he has the precedents of his flight to Australia, and Sir John Alcock's crossing of the Atlantic. He proposes to follow his London-Australia route as far as Calcutta, whence he will travel east and then north-east by the Asiatic shore of the Pacific to the Arctic Circle, crossing to Alaska, and then by way of British Columbia and the great lakes. He intends to visit New York, and then to return northwards to Nova Scotia for the dash across the Atlantic.

One of his chief cares will be to avoid the Indian monsoon season and to choose the period that will also fit in with the brief period of clear weather in the extreme north of the Pacific, which is so often fogbound. But for the greater part of the flight, and especially where the ocean has to be crossed, he will have the help of westerly trade winds.

East to West

The principal other British project will be for a big flying boat, and will take the flight in the opposite direction, using the north-east trades north of the Equator.. This route would take in Lisbon and the Azores, the American continent at its narrow middle, San Francisco, and, again on the trade winds, would go by way of Honolulu or Crusoe Island to Jaluit, Guam, and Manila. Or an alternative would be to cross the American continent at the north, taking in the great lakes, and following the Aleutian Islands and the Asiatic side of the Pacific. Much will depend upon the data that is being collected with great difficulty concerning the fog seasons in the north of the Pacific, and the weather on the Asiatic side of that ocean.

Apart from crossing in the extreme north, there is a possible route south of the Behring Sea, where the greatest separate stage would be between Unalaska and Petrapavlovsk, 1,260 miles, and thence to Yokohama, 1,380 miles. This, however, would almost certainly have to be taken from west to east on account of the prevailing winds.

Great Sea Distances

On the Honolulu-Jaluit line the greatest distances are San Francisco-Honolulu, 2,090 sea miles, and Honolulu-Jaluit, 2,130 sea miles. The greatest sea distance hitherto flown was the 1,680 sea miles by Sir John Alcock, but that was by an ordinary land aeroplane. Sir Ross Smith's choice of the northern corner of the Pacific is obviously due to the need to evade the north-east trades that would be met by way of Honolulu to San Francisco, a route of long sea distances.

The South Asiatic coast and the Philippines are subject to typhoons, most frequently met in July, August and September, and least often in February.

A project for crossing the Atlantic from east to west is engaging the Portuguese, who have chosen a British seaplane for the purpose. It is understood that the United States Naval Flying Service will soon attempt the crossing of the Pacific by way of Honolulu. The international air congress soon to assemble at Paris will discuss the advisability of establishing a competition for the round the world flight. It will be remembered that the American Aero Club were recently occupied with preparations for such a competition, but that the project fell through.

In connection with round the world flight a test which has just been completed to check up mail speed is of interest.

With a view to ascertain the time required for a letter to go around the world for the purpose of comparing with the time

(*Continued on page* 187)

EFFECT OF VARIATION IN LOAD FACTOR ON STRUCTURAL WEIGHT OF WINGS

By R. A. MILLER

Aeronautical Structural Engineer, McCook Field

Introduction

THE object of this investigation is to determine the effect of variations in load factor or useful load upon the sizes and weights of the various parts of the wings.

Assuming the formulas used by the Air Service for the solution of lift trusses and the design of spars and struts to be correct, a definite relationship is established between the useful load and the sizes of members so that it is possible for the designer to predict the resultant sizes and weights due to variations in the useful load.

It is shown that with the present methods of design the area of the spar is of first importance and that within certain limits the area of the routed spars may be arranged without regard to the effect upon the moment of inertia.

The investigation is conducted throughout in terms of the load factor, but by a simple computation the result of changing the weight of useful load instead of the load factor may be estimated.

Two sets of computations are made, one for the RAF-15 section and one for the USA-27 section, with the wing area aspect ratios, gap chord ratios, stagger and weights the same in each case, thus showing any difference in effect on a thin wing and on a moderately think one.

Consideration of the subject will show that the weight of the covering will not be affected by variation in the load factor, and that the weight of the loading and trailing edges, ribs, drag wires, etc., will be subject to little if any change. The main struts and spars will change in weight and the total weight will change in proportion. This study is therefore limited to the lift trusses.

The stresses in a typical lift truss under a load factor of 1.0 are computed, multiplied by various load factors, trusses designed for the resulting stresses, and the weights compared.

Conclusions

1. The area of spars varies directly with the load factor.
2. The area of struts varies with the load factor and the increase in area is at a slightly smaller rate than the increase in load factor.
3. The weights of the lift truss members vary with their respective areas and therefore increase at a rate slightly less than that of the load factor.
4. In considering changes in design necessitated by changes in useful load it will be on the safe side to assume that the areas and weights of members of the lift trusses vary directly with the per cent increase in the load factor, and for small increases the error will be negligible.
5. If the spars are designed as light as is consistent with good practice, small increases in useful load with the thicker wing sections may be met by decreasing the routing.
6. The structural weight of wings varies with the load factor, but does not increase as rapidly as the load factor.
7. When an increase of useful load is made in an aeroplane, it is safe to predict that the sizes and weights will increase in proportion, though the design of the members should be checked before the new sizes are given final approval. This prediction should give fairly accurate sizes, but will give weights that are heavier than they are found to be when the design is checked.

Assumptions

1. In this investigation two flight conditions were considered, high incidence and low incidence.
2. The following assumptions were made with respect to the location of the center of pressure, the angle of incidence, and the value of L/D:

U. S. A. 27

Flight Condition	Angle of Incidence	L/D	Position of Center of Pressure
High Incidence	16°	9.2	27.4 per cent
Low Incidence	−2°	7.8	63.4 per cent
R. A. F. 15			
High Incidence	12°	10.7	29.0 per cent
Low Incidence	0°	8.1	44.3 per cent

3. The standard decrease in loading on the wing tips was assumed.
4. The lower wing was assumed to be 86 per cent as efficient as the upper wing in high incidence and 87 per cent as efficient as the upper wing in low incidence, in accordance with division of load between wings as recommended in Art. 44 of "Structural Analysis and Design of Aeroplanes."
5. The wing tips were assumed to be square.
6. The spars were assumed to be hinged at the cabane struts.
7. The lift wires were crossed so that their drag effect would relieve the direct stresses in the spars.
8. The weight of the wings was assumed at 1.00 lb. per sq. ft. and the gross wing loading was assumed at 8.0 lb. per sq. ft. in computing the stresses in the struts and spars. No correction of the stresses was made to allow for the actual weights of each design.
9. The spars were assumed to be at 12 per cent and 67 per cent of the chord.
10. The aerodynamic characteristics assumed for the USA-27 section were obtained from the wind tunnel tests at M.I.T. in November, 1920; those for the RAF-15 section were obtained from the wind tunnel test at M.I.T. in December, 1919.
11. The location of the outer strut, bay 1-2, and cantilever length were determined by the recommended proportions in Art. 34 of "Structural Analysis and Design of Aeroplanes."
12. The drag truss was divided into 3 panels between the cabane and outer struts.

General Data

Weight of aeroplane, without wings	2400 lbs.
Total span of wings	31.5 ft.
Gap	68 in.
Chord of both wings	68 in.
Stagger	+13.6 in.
Length of center section, both wings	30 in.
Length of bay, both wings	110 in.
Length of cantilever section, both wings	64 in.
Area of upper wing	178.6 sq. ft.
Area of lower wing	164.4 sq. ft.
Weight of wings	343 lbs.
Distance from leading edge to front spar	8.16 in.
Distance from leading edge to rear spar	45.56 in.

Computations

1. The stresses, moments, etc., in the lift trusses are computed for a load factor of 1.0 according to the method in Chapter III of "Structural Analysis and Design of Aeroplanes," the distribution between the front and rear lift trusses effected, and the direct stress in the spars corrected for the drag truss stresses.
2. Multiplying by the various load factors, we have the moments, shears, stresses, etc., as shown in Tables I and II.
3. The spars were designed for both the USA-27 section and the RAF-15 section for the stresses, moments, etc., resulting at the various load factors the method in Art. 174 of "Structural Analysis and Design of Aeroplanes" being used.
4. The struts were designed for the loads at the different load factors with sizes as shown in Tables IX and X. The method in Art. 91 of "Structural Analysis and Design of Aeroplanes" was used, combined with Euler's formula for pin-ended columns:

$$P = \frac{\pi^2 \cdot EI}{L^2} \text{ or } I = \frac{PL^2}{\pi^2 E}$$

Assuming a standard streamline wood strut with a fineness of 4, with L = the length of the strut cross section and D the width.

$$I = .0432LD^3$$

As $L = 4D$

$$I = .1728D^4$$

$$A = .730LD = 2.92D^2$$

$$A^2 = 8.53D^4 \text{ and } \frac{A^2}{49.34} = .1728D^4$$

Then

$$I = \frac{A^2}{49.34}$$

Then $\frac{A^2}{49.34} = \frac{PL^2}{\pi^2 E}$ and $A = .001768 \times L \times \sqrt{P}$

where A = cross sectional area,
L = length of strut, and
P = comp. in strut

5. Curves were plotted showing the variation of the cross sectional area of the spars in the routed portion in terms of the load factor, see Fig. I.

6. Curves showing the variation in weight of the spars in terms of the load factor were plotted, see Fig. II. In computing these weights it was assumed that there would be a 10 in. unrouted length at the strut points, a 12 in. unrouted length at the wing tips, and 5 in. was subtracted from each 12 in. unrouted portion at the wing tips to allow for the taper of the spars at that point. The spars were considered to be of spruce and to weigh 27 lbs. per cu. ft.

7. Curves were plotted showing the variations of the cross sectional area of the outer struts in terms of the load factor, as shown in Fig. III.

Discussion

1. The characteristics of the spars designed show that the area varies directly as the load factor.

2. It will be observed that the weight of the spar varies with the load factor, but not directly with it, as the curves shown in Fig. II take the form $Ax + BY = K$. For this particular case, K is undoubtedly the excess area added at the strut points and compression ribs to provide sufficient area for the fittings, to transfer stresses from the ribs, struts and wires to the spars and to each other, and to stiffen the spars for drag bending. Doubling the load will not double the weight of the spar, though the error in any case is on the safe side, and for small increases in the load factor the error would be so small as to be negligible.

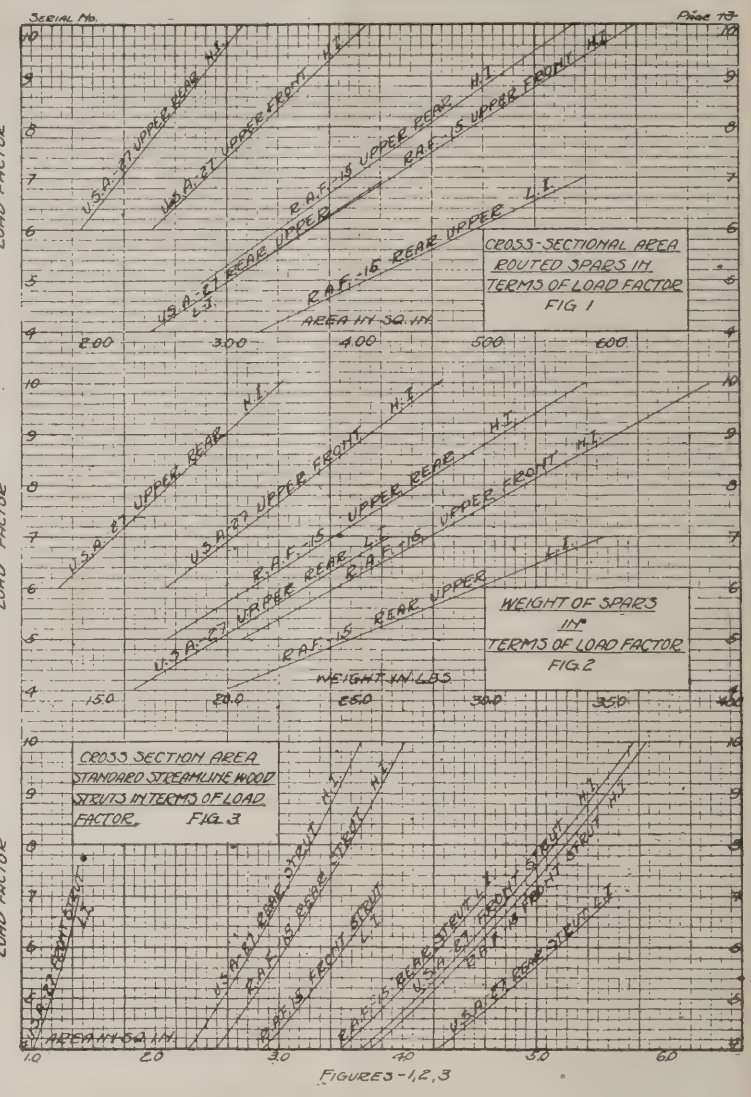
3. The deflection of a spar with constant load and span varies inversely as the moment of inertia, so that an unrouted spar shows greater deflection for a given load than a routed spar of the same area and center height.

4. While the computations made during this investigation have not been as comprehensive in regard to the effect on the F.S. of variations in the moment of inertia as might be desired, they indicate that for a given load and with constant area and center height, small variations in the amount of inertia have little if any effect upon the F.S.; and that with constant load, constant span, constant area of the routed portion and center height, the moment of inertia may vary at will with little effect upon the F.S., so long as the ratio of the area of the routed portion to the area of the unrouted portion remains between 50 per cent and 80 per cent. However, the characteristics of a spar, a typical case being listed in Table XI, would indicate that as the area ratio approaches 80 per cent the best spar in regard to minimum weight is obtained.

5. In many cases, more especially with the thicker wing sections, when it is desired to amend a design for small increases in useful load, the area of the spar can be increased by decreasing the routing up to a point where the ratio of the area of the routed portion to that of the unrouted portion equals 75 per cent to 80 per cent, thus keeping the spar as light as possible and effecting a saving in the redesign of ribs, fittings, etc.

6. According to the formula for struts, the area varies with the length and with the square root of the load.

7. The curves for the area in terms of the load factor, see Fig. III, show that with the length constant, the curve for the area in terms of the load factor is nearly a straight line.



8. If the area of a strut with constant length be increased in proportion to the load factor, the error will be on the safe side in any case, and for small increases in the load factor the error will be negligible.

9. The curves in Fig. II show that the USA-27 section has lighter spars than the RAF-15 section, and the curves in Fig. III show that the USA-27 section has a lighter front strut, while the RAF-15 section has a lighter rear strut due to the difference in center of pressure travel. However, computations will show that the two struts with the RAF-15 section are but very little lighter than those with the USA-27 section at the load factors of design for pursuit aeroplanes. With the thicker wing section, the ribs and compression struts would be heavier, but the difference in weight would be small as it would be due mostly to increased web area. Because of the greater spar height in the USA-27 section it is possible, in spite of the increased center of pressure travel, to design spars so much lighter than with the RAF-15 section as to overcome the increased weights due to heavier struts, ribs and compression struts and to effect a considerable saving in the structural weight of the wings.

A Cute Little Aviator

How a mouse took a ride in an aeroplane is being discussed over in Plainfield, N. J., where Harris W. C. Browne, who has a D. H. 6 which he keeps in a hangar on Greenbrook Road, took his ship out one morning last week and when up about 2,000 feet was surprised to see a field mouse running along the back of the front cockpit. The little fellow did not seem to be scared at all, and after looking around for a moment sprang down into the cockpit and disappeared from the view of the pilot. When the plane landed it was discovered that the mouse had gnawed a hole in the seat cushion, taken out some hair and built a nest in a corner under the life belt. The aeronautic mouse was allowed to escape and is probably the only mouse in existence that ever went up 2,000 feet in a plane and lived to tell the tale. The question is, what would Ruth Law have done if she had been the pilot?

Montgomery Field Record

Altitude records made by planes from the Montgomery Air Intermediate Depot were broken recently when a machine of the De Haviland 4B type, with 1st Lieut. Lloyd Barnett and James Wilson, civilian mechanician at the depot, on board reached the height of 20,300 feet, nearly four miles above the earth's surface. Possibly this record may not be equalled throughout the country by machines of similar type and equal weight to the Montgomery plane, which was about 5,000 pounds.

While natives of Montgomery, clad in Palm Beach suits, were sweltering in a temperature which ranged high in the eighties, the flight pilot and his civilian companion, who left the ground four miles outside of the city proper, came near freezing at the height their machine attained, although they wore winter clothing. The two men also experienced much difficulty in breathing in the rarefied atmosphere.

PRELIMINARY CALCULATION OF CYLINDER DIMENSIONS FOR AIRCRAFT ENGINES

By OTTO SCHWAGER *

THE hitherto customary methods for calculating cylinder dimensions rest on the assumption of a definite average working pressure, whose more or less accurate valuation depends on the results of previous experiments. Consequently they are to a certain extent unreliable. It is especially important in building aircraft engines to determine the requisite dimension as accurately as possible, in order that the weight required for a given power shall not be excessive. The following calculation method depends therefore on the air requirement of the fuel.

I. Air Requirements

Gasoline has a heat value of $h_u = 10000$ to 10500, or an average of 10250 heat units (HU) per kilogram. The composition of gasoline is not constant. We may assume an average composition (by weight) of

85.5% C + 14.5% H

The combustion of 1 kg. of gasoline therefore requires

$$0.855 \cdot \frac{8}{3} 0 + 0.145 \cdot 8 0 = 3.44 \text{ kg. } 0$$

corresponding, for an average composition of the air of 23.6% 0 and 76.4% N, to

$$\frac{3.44}{0.236} \sim 14.6 \text{ kg. air.}$$

If we take as the normal conditions of the air 15°C and 760 mm. Hg., corresponding to an air density of ~ 1.2 kg. per cu.m., then $\frac{14.6}{1.2} \sim 12.2$ cu.m. of air will be required for the combustion of 1 kg. of gasoline.

For complete combustion a certain excess of air is, however, advisable, which for aircraft engines may be set at 10% for economical consumption. The actual air consumption for the combustion of 1 kg. of gasoline in a recently built aviation engine is therefore

$$(1 + 0.1) \cdot 12.2 = 13.4 \text{ m.}^3$$

The volume of 1 kg. gasoline vapor may be set at 0.27 cu.m. The volume of a mixture containing 1 kg. of gasoline, with an average of 10250 heat units, is therefore

$$13.4 + 0.27 = 13.67 \text{ m.}^3$$

and hence the thermal value of 1 cu.m. of the fuel mixture, at 15°C and 760 mm. Hg. is

$$H_o = \frac{10250}{13.67} \sim 750 \text{ HU/m.}^3$$

This thermal value of the mixture may be advantageously employed in the preliminary calculation of the cylinder dimensions for a given engine power.

Under other atmospheric conditions then 15°C and 760 mm. Hg., the thermal value of the mixture changes in proportion to the density of the air and the absolute "heat per cubic meter" may be expressed by

$$H = H_o \cdot \mu \text{ in } \mu = \frac{273 + 15}{273 + t} \cdot \frac{b}{760}$$

or the relative density of the air.

II. Preliminary Calculation of Cylinder Dimensions and Fuel Consumption

Designate by N_e the desired brake horsepower of the engine;

μ the relative air density for which N_e is desired;
n the r.p.m. of the engine;
η_m the mechanical efficiency;
η_t the thermal efficiency;
η_g the quality of the cycle efficiency (degree of completeness of the diagram);
Q the heat consumption of the engine in HU per hour;
q the heat consumption in HU per HP hour;
(V_h) theoret, the theoretically required fuel mixture in cu.m. per hr.;
η_l the delivery efficiency of the engine working as an air-pump;

$(V_h)_{eff} = \frac{(V_h)_{theoret}}{\eta_l}$ the actually required suction-stroke volume in cu.m. per hr.;

v_h the total stroke space of the engine in l;
η_w the economical efficiency;
b the fuel consumption in grams per HP hour;

The hourly heat consumption of the engine is calculated by

$$Q = \frac{N_e \cdot 632}{\eta_m \cdot \eta_t \cdot \eta_g} \text{ HU/hr.}$$

Since 1 cu.m. of the mixture at the relative air density μ has a heat content of $H = H_o \mu$, the theoretical hourly intake requirement of the mixture is calculated by

$$(V_h)_{theoret} = \frac{Q}{H_o \cdot \mu} = \frac{N_e \cdot 632}{\eta_m \cdot \eta_t \cdot \eta_g} \cdot \frac{1}{H_o \cdot \mu} \text{ m}^3\text{/hr.}$$

and the actually required suction-stroke volume by

$$(V_h)_{eff} = \frac{N_e \cdot 632}{\eta_m \cdot \eta_t \cdot \eta_g} \cdot \frac{1}{H_o \cdot \eta_l} \cdot \frac{1}{\mu} \text{ m}^3\text{/hr.}$$

For a four stroke cycle engine there follows herefrom the total stroke volume in l (liters)

$$v_h = \frac{N_e \cdot 632}{\eta_m \cdot \eta_t \cdot \eta_g} \cdot \frac{1}{H_o \cdot \eta_l} \cdot \frac{1}{\mu} \cdot \frac{1000 \cdot 4}{60 \cdot n \cdot 2} l.$$

$$v_h = \frac{21100 \cdot N_e}{\eta_m \cdot \eta_t \cdot \eta_g \cdot n} \cdot \frac{1}{H_o \cdot \eta_l} \cdot \frac{1}{\mu} l.$$

This general fundamental comparison for the total stroke volume of the engine applies to every kind of engine, whether it be an engine of ordinary construction whose power decreases with the altitude or a high altitude engine, over-compressed or over-dimensioned. For the latter μ must be given a value corresponding to the altitude until constant engine power is reached. For ordinary engines $\mu = 1$.

The degrees of efficiency to be used in the equation depend on the kind of engine, whether it is air or water cooled, fixed or rotary (ordinary or Siemens-Halske type) and further from the method of construction of the cylinders, whether the valves are in the cylinder heads or in side chambers. For the most important kinds of aircraft engines, the different degrees of efficiency are calculated as follows:

(*a*) *Water-cooled fixed engines (hanging valves in the cylinder head)*

$\eta_m = 0.85$ to 0.9 (For safety's sake, it is better to use 0.85 in calculations).

$\eta_g = 0.8$ to 0.85 (Average 0.825).

$\eta_l = 0.85$ (For gas velocities up to 100 m. per second based on the highest piston speed to be constantly attained with safety).

η_t depends on the degree of condensation. It is

$$\eta_t = 1 - \epsilon^{1-x}$$

in which $x = 1.35$.

(*b*) *Air-cooled Stationary Engines*

On account of the hotter gliding surfaces, especially of the piston,

$$\eta_m = 0.82$$

The quality is not much poorer than for water-cooled engines, only for engines with lateral valve chambers it is poorer on account of the larger cooling surface of the combustion chamber. It may be set at

$\eta_g = 0.77$ for engines with later valve chambers and

$\eta_g = 0.8$ to 0.82 for engines with valves in the cylinder heads.

The efficiency of supply for like gas velocities, as for water-cooled engines depends according to the quality of the cooling, on the uniform laving of the heat conducting surfaces, the avoidance of overheated places in the combustion chamber, etc.

$\eta_l = 0.77$ to 0.8. Only under especially favorable conditions with gas velocities below 70 m. per second, can $\eta_l = 0.85$,

* "Zeitschrift fur F & M," December 31, 1920, translated by the National Advisory Committee for Aeronautics.

as in water-cooled engines. Hereby, as in all othes cases, mechanically operated intake valves are essential.

(c) Rotary Engines

The following values may be used:

$\eta_m = 0.82$;

$\eta_l = 0.77$ to 0.8;

$\eta_g = 0.65$ to 0.7 (average 0.68).

The quality is therefore considerably poorer than for fixed engines, because an excess of fuel is used for rotary engines, in order to prevent the combustion of the lubrication oil (which gets into the combustion chamber in considerable quantities) and to keep the engine cool. The thermal value of the mixture is therefore higher for these engines and indeed H_o equals 800 to 900 (average 850) heat units per cubic meter.

Furthermore, in the case of rotary engines, it must be remembered that a certain amount of power is absorbed by the cooling resistance, which in ordinary rotary engines, at 1250 r.p.m., is from 8 to 12%, and in the Siemens-Halske type, at 900 r.p.m., is from 4 to 6%.

A still broader efficiency, which may be called the cooling efficiency η_v and may be inserted in the general fundamental quation. The following may be taken as its average values:

η_v = 0.88 to 0.90 for ordinary rotary engines;

η_v = 0.95 to 0.96 for the Siemens-Halske type.

From the efficiency, the anticipated fuel consumption per HP-hour is calculated as follows:

The economical working or over-all efficiency is

$$\eta_w = \eta_m \cdot \eta_t \cdot \eta_q \text{ resp.} = \eta_m \eta_t \eta_g \cdot \eta_v$$

and the heat consumption per HP-hour is

$$q = \frac{632}{\eta_w} \text{ HU/HP-hr.}$$

from which is obtained the fuel consumption

$$b = \frac{q \cdot 1000}{h_u} \text{ g/HP-hr.}$$

III. Examples

In the following examples, the serviceability of the above method of calculation and the correctness of the efficiency values are demonstrated.

(a) Water-cooled Fixed Engine (ordinary engine)

N_e = 180 HP, μ = 1

n = 1400 r.p.m.

ϵ = 4.65, corresponding η_t = 0.416

$$v_h = \frac{21100 \cdot 180}{0.85 \cdot 0.416 \cdot 0.825 \cdot 1400} \cdot \frac{1}{750 \cdot 0.85} \cdot \frac{1}{1} \sim 14.6\ l$$

$$\eta_w = 0.85 \cdot 0.416 \cdot 0.825 = 0.292$$

$$q = \frac{632}{0.292} = 2160 \text{ HU/HP-hr.}$$

$$b = \frac{2160 \cdot 1000}{10250} \sim 210 \text{ g/HP-hr.}$$

This corresponds very closely to the 160 HP Daimler-Mercedes $DIII_a$, which gives about 180 HP at d = 140 mm., s = 150 mm., i = 6, hence v_h = 14.7 *l*, ϵ = 4.65 and n = about 1400, and averages about 200 to 220 grams of gasoline per HP-hr.

(b) Water-cooled Engine (high altitude)

N_e = 185 HP, remaining constant to μ = 7

n = 1400 r.p.m.

n = 1400 r.p.m.

ϵ = 6.3, corresponding η_t = 0.47

$$u_h = \frac{21100 \cdot 185}{0.85 \cdot 0.47 \cdot 0.825 \cdot 1400} \cdot \frac{1}{750 \cdot 0.85} \cdot \frac{1}{0.7} \sim 19\ l$$

$$\eta_w = 0.85 \cdot 0.47 \cdot 0.825 = 0.33$$

$$q = \frac{632}{0.33} = 1920 \text{ HU/HP-hr.}$$

$$b = \frac{1920 \cdot 1000}{10250} = 187 \text{ g/HP-hr.}$$

Here there is excellent agreement with the 185 HP-BMW IIIa engine, which still gives 185 HP with d = 150 mm., s = 180 mm., i = 6, hence v_h = 191 *l*, n = 1400 r.p.m., ϵ = 6.3 and μ = 0.7, with a fuel consumption of 185 to 190 g/HP-hr.

(c) Air-cooled Fixed Engine (normal engine with lateral valves)

N_e = 74 HP, μ = 1

n = 1620 r.p.m.

ϵ = 4, corresponding η_t = 0.384

$$v_h = \frac{21100 \cdot 74}{0.82 \cdot 0.384 \cdot 0.77 \cdot 1620} \cdot \frac{1}{750 \cdot 0.77} \cdot \frac{1}{1} \sim 6.9\ l$$

$$\eta_w = 0.82 \cdot 0.384 \cdot 0.77 = 0.242$$

$$q = \frac{632}{0.242} = 2610 \text{ HU/HP-hr.}$$

$$b = \frac{2610 \cdot 1000}{10250} = 254 \text{ g/HP-hr.}$$

Here there is also good agreement with a similar-powered engine, the 70 HP Renault, which gives about 74 HP with d = 95 mm., s = 120 mm., i = 8, hence v_h = 6.8 *l*, n = 1620 r.p.m., ϵ = 4, with a fuel consumption of 260 g/HP-hr.

(d) Air-cooled Fixed Engine (modern radial with overhead valves)

N = 345 HP, μ = 1

n = 1650 r.p.m.

ϵ = 5, corresponding η_t = 0.43

$$v_h = \frac{21100 \cdot 345}{0.82 \cdot 0.43 \cdot 0.82 \cdot 1650} \cdot \frac{1}{750 \cdot 0.85} \cdot \frac{1}{1} \sim 24\ l$$

$$\eta_w = 0.82 \cdot 0.43 \cdot 0.82 = 0.289$$

$$q = \frac{632}{0.289} = 2190 \text{ HU/HP-hr.}$$

$$b = \frac{2190 \cdot 1000}{10250} = 214 \text{ g/HP-hr.}$$

These values correspond well with the English A.B.C.-Dragonfly engine, which, with d = 5.5 in. or 139.7 mm., s = 6.5 in., or 165.1 mm., i = 9, hence v_h = 22.8 *l*, n = 1650 r.p.m., has a power of N_e = 340 BHP ~ 345 HP, with a fuel consumption of 0.56 pint/BHP ~ 220 g/HP-hr.

(e) Rotary Engine (ordinary)

N_e = 120 HP, μ = 1

n = 1200 r.p.m.

ϵ = 5, corresponding η_t = 0.43

Taking as a basis

η_m = 0.82, η_g = 0.68, η_l = 0.77, η_v = 0.88 and Ho = 850 HU/m³

we obtain

$$v_h = \frac{21100 \cdot 120}{0.82 \cdot 0.43 \cdot 0.68 \cdot 1200} \cdot \frac{1}{850 \cdot 0.77} \cdot \frac{1}{1} \cdot \frac{1}{0.88} \sim 15.3l$$

$$\eta_w = 0.82 \cdot 0.43 \cdot 0.68 \cdot 0.88 = 0.21$$

$$q = \frac{632}{0.21} = 3010 \text{ HU/HP-hr.}$$

$$q = \frac{3010 \cdot 1000}{10250} = 3010 \text{ HU/HP-hr.}$$

These values approximate those for the 110 HP Rhone engine, Oberursel copy, which, with d = 113 mm., s = 170 mm., i = 9, hence v_h = 15.1 *l*, n = 1200 r.p.m. ϵ = 5, gives a net power of 120 HP with a fuel consumption of 305 g/HP-hr.

(f) Rotary Engine (Siemens-Halske type, high-altitude engine)

N_e = 160 HP, constant to μ = 0.7

n = 900 + 900 = 1800 r.p.m.

ϵ = 5, corresponding η_t = 0.43

$$v_h = \frac{21100 \cdot 160}{0.82 \cdot 0.43 \cdot 0.68 \cdot 1800} \cdot \frac{1}{850 \cdot 0.77} \cdot \frac{1}{0.7} \cdot \frac{1}{0.95} \sim 18.1l$$

$$\eta_w = 0.82 \cdot 0.43 \cdot 0.68 \cdot 0.95 = 0.228$$

$$q = \frac{632}{0.228} = 2770 \text{ HU/HP-hr.}$$

$$b = \frac{2770 \cdot 1000}{10250} = 270 \text{ g/HP-hr.}$$

Here also is good agreement with a similar-powered engine, the 160 HP Siemens-Halske H-SIII, which, with d = 124 mm.,

(*Concluded from page* 187)

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

North Carolina

Western part of state quite rough. Central part, good level open country, many large open fields. Soil is mostly loose sand, and although quite good for landing, it makes very slow take-off.

WINSTON-SALEM, N. C., to DANVILLE, Va., hilly, not much chance landing.

DURHAM, field here is very dangerous, stay off.

DURHAM to GREENSBORO, very good country. GREENSBORO to WINSTON-SALEM via HIGH POINT and LEXINGTON, landing fields all through, not so hilly. WINSTON-SALEM to MOUNT AIRY, mountainous land except right near MOUNT AIRY (town).

WEST SALEM to STATESVILLE, fields all the way, hilly. STATESVILLE to TAYLORSVILLE, mountainous, no chance landing. STATESVILLE to CHARLOTTE, hilly, landing possible. CHARLOTTE to GREENVILLE, gets very hilly toward GREENVILLE, not good anywhere.

North Carolina is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

Striking south and west from LANGLEY FIELD, Va., across CHESAPEAKE BAY, following the Atlantic Coast Line R. R. through Norfolk and on through Suffolk into North Carolina to RALEIGH, the terrain here is very good; no landing fields at all for about fifty miles. Then one begins to see small plowed fields and pine trees, with only an occasional green field, few of which could be landed in with any degree of safety. Most of North Carolina is like this. Continuing along this route, through TARBORO and ROCKY MOUNT and then the Southern R. R. from WILSON; there are fields at Rocky Mount and Wilson, which have been used for commercial aviation. The eastern part of the state is hopeless. In the central part there are a few landing fields, and two government aerodromes—one is at WINSTON-SALEM; CHARLOTTE and DURHAM and GREENSBORO have commercial fields. RALEIGH is poor territory. The western part of the state is mountainous.

Along the route GREENSBORO to LANGLEY FIELD, Va., through Virginia, conditions are a little better.

North Dakota

Country west of FARGO perfectly level and land almost anywhere. Lots of places to land all around FARGO.

All of North Dakota is especially adapted and offers any number of suitable landing fields in case of forced landings. With the exception of a district in Bottineau County, known as the Turtle Mountains and a small territory in the southwest corner of the state, there is no place where safe landings could not be made with any of the low powered planes used extensively today. During the period when growing grain has obtained its full height just before harvest, the hazard is slightly increased as there is some danger of "Nosing Over" in case of landing in long grass or grain.

North Dakota is one vast prairie in the eastern half of the state, with the same condition prevailing over the western half except that in the latter part there is some land which is very rough, but no machine has ever been heard of crashing due to a mistake in the judgment of a pilot in this part of the country.

North Dakota is a very good state over which to fly. One could possible fly over it at an altitude of three or four thousand feet and set a ship down anywhere on broad level prairie.

North Dakota is an ideal state for flying, flat country with large open fields, not much timber or swamp land, only the north central and southwestern corner is very hilly. Planes operating in North Dakota run the very minimum landing risk.

From FARGO, N. D., to MINNEAPOLIS, Minn., good for first two hundred miles, bad from then on.

FARGO to WILLISTON—fine.

FARGO to GRAND FORKS—fine.

FARGO to WINNIPEG, CAN.—fine.

At FARGO the land is flat and dry, and landing fields are plentiful, at the town itself planes land at the race track.

At GRAND FORKS the land is flat and dry, and there is a splendid landing field at the fair grounds.

At WAMPETON the country is flat and dry, and landing fields are plentiful.

Ohio

From DAYTON to PITTSBURGH, Pa., is a good route until you run into mountainous section.

There is a good landing field at COLUMBUS, Ohio, and the country following the route from the northeast corner to the southwest corner is good all the way through.

Ohio on the average is very good. That portion of Ohio on a line running east to COLUMBUS north is for the most part good flying country.

On the mail route NEW YORK-CLEVELAND, there are few places a pilot could make a forced landing without damage to his ship, although it is not impossible. The mail field at BELLEFONTE, Pa., is bad and the route is hard to pick up. The route—CLEVELAND-CHICAGO, of course, is very good, as it would be possible to pick a safe landing place at any time—route is easy to follow and the mail has a good two way field about half way. MARTIN FIELD at Cleveland is very good for any machine.

INDIANAPOLIS to DAYTON, Ohio, is good. From DAYTON to LOUISVILLE, Ky., is extremely poor, especially after leaving HAMILTON, Ohio. From that place to within about twenty or thirty miles of LOUISVILLE, not even one good landing field can be used in case of motor trouble.

On the CHICAGO - CLEVELAND route, passing over BRYAN, Ohio, the land east from the Illinois line to a point ten miles east of GARY, Ind., is swampy or with a scrub growth or sand dunes, unless swinging around more than five miles south of Lake Michigan. In the balance of the route over Indiana there are short stretches of territory of probably not over ten per cent of the distance altogether on which a dead stick landing without damage would be difficult, but not impossible, due to rolling terrain and numerous groves. In Ohio, in the immediate vicinity of the Maumee River there is quite wet and soft ground during the rainy season. Within a radius of five miles of city limits of CLEVELAND the ground is quite difficult and fields very small. The weather across Indiana, over the lakes region in particular, is quite difficult during rainy seasons, but very rarely impassable, while the weather in Ohio has never been found impassable.

From Johnstown, Pa., through Youngstown, Canton, Akron, Warren and Cleveland, Ohio, country is very good after leaving Pittsburgh, being mostly open and very level.

From SHARON, Pa., to YOUNGSTOWN, Ohio, is fairly good. Thence to PARKERSBURG, W. Va., via MOUNDSVILLE, W. Va., fair for 25 miles out of YOUNGSTOWN until strike Ohio River, then very bad to MOUNDSVILLE.

Oklahoma

ELK CITY, fairly level. CHEYENNE, same, high hills on south. LEEDY, same, level. BEAVER CITY, same, rolling. ANTLERS, rough. WAYNOKA, farm land, rolling, rough on east. GAGE to LAVERNE, rolling pretty choppy. LAVERNE to TYRONE, long rolling, air fair. WAYNOKA to PRATT, Kans., farms, rolling, safe alt. 3,000 feet. TYRONE to GUYMON, nearly level, little rough GUYMON. GUYMON to TEXHOLA, little rough, nearly level, safe alt. 2,000' GUYMON to LIBERAL, Kans., same.

The northern part of Oklahoma is good. In the eastern part the country is fine as far south as TULSA. From there to the southern boundary the country is nearly all rock hills covered with scrub timber and would be very dangerous for a forced landing. There is an aerodrome at OKMULGEE on this route and a good landing field at COTTONWOOD FALLS. The western route crosses the Wichita Mountains south of OKLAHOMA CITY, but they are not more than 30 miles wide. The rest of the country is good.

North and east of TULSA and OKLAHOMA CITY is good.

From WICHITA and PARSONS, KANSAS, south to TULSA, Okla., is pretty fair flying country. From TULSA to FORT WORTH, Texas, is all good territory.

Most of Oklahoma is good, very little difficulty need be experienced finding landing fields. Pilots should be advised to be very careful regarding weather in all parts of the Pan Handle during the spring of the year on account of high winds which blew many machines away last year, even when well staked to the ground. Also care needs to be exercised regarding sand storms there during those months.

The air in Western Oklahoma is none too good for a novice to work in.

From MONETT, Mo., to TULSA, Okla., 128 miles, has good landing fields all the way, mostly in 260 acre tracts. Gasoline and oil can be gotten at any town on the route. There is a large Curtiss Field at TULSA about 4 miles northwest

from the city, and also a Bristol Field 1½ miles from the Curtiss Field. They do repair work and rebuilding. Leaving TULSA going due south for 60 miles, one will reach the Creek County Aeraplane Co.'s Field. The ground between TULSA and OKMULGEE is smooth and one can land anywhere. DALLAS, Texas, is due south from OKMULGEE, Okla., and it is a regular air route, lots of good fields.

To go to OKLAHOMA CITY from TULSA is 135 miles and the nearest way is to follow the Frisco R. R. tracks; good country all the way and good field west of city at Golf Club.

From ARKANSAS CITY west to WOODWARD, Okla., all country south of this to WACO, Texas, is open and wonderful country to fly over and very flat, with the exception of a little string of mountains that run west from Ft. Sill. These mountains are low and about two miles across in the widest place. All of Oklahoma is good country to fly over with the exception of the southwest part of the state, which has quite a bit of timber.

Pennsylvania

PITTSBURGH and vicinity, good landing fields are scarce. One should avoid the country east of PITTSBURGH. There are one or two good landing fields around here.

Central Pennsylvania is practically all mountains, poor flying territory between PHILADELPHIA and HARRISBURG. Following the P. R.R. lines through Coatesville, Lancashire to Harrisburg, very safe route, conditions of the ground, mostly flat, cultivated fields, numerous good landing places. From HARRISBURG north to SUNBURY, country very mountainous. It is dangerous territory to fly over, very bumpy in the air and the valleys are so rolling that they present poor fields in which to land. When flying from HARRISBURG to SUNBURY follow Susquehanna River, keep an altitude of 5,000′ and the landing field will always be within gliding distance. Cultivated islands in the river are good to land on.

At Clarks Ferry, Millersburg, Selinsgrove Junction and Sunbury pilots flying along the Susquehanna River should be warned that at MILLERSBURG, some 20 miles north of HARRISBURG, there are four wide cables stretched across the river between the mountains at opposite sides, mountains 2 000′ high; cable starts from peaks, sags in centre to above 50 feet of water in river like Lykens Valley, in which is situated towns of Williamtown, Lykens and Wiconisco. Dangerous valley for flying, being nearly closed in at both ends makes air practically dead. Only experienced pilots should risk landing in this valley. From CLARKS FERRY to LEWISTOWN, country very rolling and mountainous. No fair landing places until TOMPSONTOWN is reached. BLOOMSBURG and BERWICK, good landing territory. At SUNBURY, mail pilots often land on large flat island in center of river. Farmers object to planes landing here.

The western part of Pennsylvania is not good flying country. There is very poor flying country over the following counties: Warren, McKean, Elk, Potter, Cameron, Jefferson, Clearfield, Clinton, Lycoming, Tioga, Cambria, Indiana Counties. This part of the state is not swampy, but it is hilly and in places rocky. It is not the kind of country that a pilot can feel at ease in while flying over.

The condition of the land in Pennsylvania west and north of WILKES-BARRE to the borders of Ohio and New York State respectively, hills and mountains in this section are very numerous, but a pilot on a cross-country flight over this territory can find a landing field in any valley in case of trouble if at a safe height.

Route from PHILADELPHIA to PITTSBURGH:

Leaving PHILADELPHIA, following the P. R.R. to LANCASTER, there are many forced landing fields, country comparatively level. Aviation field northeast of LANCASTER good two-way field.

Leaving LANCASTER to HARRISBURG, following P. R.R., level country. Landing field at southern city limits, near railroad.

Leaving HARRISBURG, taking southerly course over and following the CUMBERLAND VALLEY, landing at MERCERSBURG, having all level country from HARRISBURG to WEST MERCERSBURG. Land at small field at southwest city limits.

Leaving MERCERSBURG to west for PITTSBURGH, go one mile north over LINCOLN HIGHWAY, turning and following it all the way, landing field at LIGONIER, near small lake, one at IRWIN on left of Highway one mile east of IRWIN, then to PITTSBURGH, landing in SCHENLEY PARK.

The route from MERCERSBURG to PITTSBURGH is rather a hazardous trip unless one is near the fields mentioned, as the country is very mountainous and positively no landing fields.

In the INDIANA COUNTY territory there is no risk, as there are many fields that can answer for landings.

The mail field at BELLEFONTE is bad and the route is hard to pick up.

ATLANTIC CITY via PHILADELPHIA to LANCASTER, PA. Fairly good country. Good field at point near PHILADELPHIA. Country affords open fields and farm lands en route and lots good fields near LANCASTER. One field fairly good right in the city—F. & M. College grounds.

LANCASTER to YORK, PA., open fields and good country. YORK to HAGERSTOWN, MD., O.K. part of the way, but approaches Alleghany Ranges and rapidly becomes worse until it is really unfit for flying unless motor is sure. Thence to JOHNSTOWN, very bad, only one field there fairly good. Thence to PITTSBURGH, very dangerous. Thence to YOUNGSTOWN, CANTON, AKRON, WARREN and CLEVELAND, Ohio, country very good after leaving PITTSBURGH, being mostly open and very level. NEWCASTLE, Pa., fairly good.

NEW YORK CITY starting from ROOSEVELT FIELD, L. I., rather poor in event of forced landings, growing worse around vicinity of DELAWARE WATER GAP and bad approaching SCRANTON, PA. Heading towards ELMIRA, N. Y., rather better than bebore, but still far from good, although there are fields for forced landings at WYALUSING and TONAWANDA. Fairly good country near ELMIRA. Lots of good fields a few miles west. Thence to OLEAN rather poorer country, not so many fields. Thence to WARREN, PA., growing worse all the time. Poor chance here. Thence to SHARON, PA. via FRANKLIN and OIL CITY. Bad territory; forced to stick to river valley; river only place to land. One field near FRANKLIN up on high hill.

SHARON to YOUNGSTOWN, OHIO, fairly good.

BUFFALO, N. Y. to ERIE, PA., very good all along LAKE ERIE and good fields at ERIE. Thence to SHARON, PA., very fair open fields.

Rhode Island

Country around WESTERLY, R. I., within a radius of 10 to 12 miles is very rocky, with many uneven landing fields. A landing can be made, but one should be very careful in choosing the field.

From PROVIDENCE to BOSTON, one can follow fairly good country, evenly sprinkled with landing fields, but few should be used except in case of an emergency. The Aviation Field of Rhode Island at PROVIDENCE is an excellent field.

Across Mass. from SPRINGFIELD to WOONSOCKET, R. I., from an altitude of 7000′ to 8000′ a field fit to land in was not observed. All woods and hills.

To the south of WOONSOCKET there is one fair field, and flying north from there to LOWELL, MASS. and out the Merrimac River to NEWBURYPORT, MASS., there are plenty of suitable landing fields.

South Carolina

COLUMBIA to AUGUSTA, GA., good fields first 60 miles, no fields last 15. COLUMBIA to BENNETTSVILLE, good fields all the way except around CHEROW.

GREENVILLE to COLUMBIA, no fields till within 20 miles of COLUMBIA, then plenty of pasture near ricer. COLUMBIA to BARNWELL, good country last mostly anywhere. BARNWELL to SUMTER, good country, land anywhere except from PEEDEE SWAMP, 4 miles wide. SUMTER to FLORENCE, good country, land mostly anywhere. BARNWELL to PARIS ISLAND, forced landings possible, as well as in YEMASSEE, almost impossible between YEMASSEE and PARIS ISLAND, very deceptive as tide goes out and leaves very soft marshes that appear to be very beautiful pastures from the air.

COLUMBIA to WINSTON-SALEM, N. C., very poor country, lucky if landing can be made without damage anywhere, very hilly.

Flying in the immediate vicinity of DARLINGTON is not hazardous, but rather inconvenient, owing to scarcity of suitable landing fields. On the border of DARLINGTON and MARLBORO COUNTIES there is a river-swamp to the northwest that necessitates plenty of altitude in crossing, and the same holds true of the southwestern border of SUMTER COUNTY, but aside from those there are no natural difficulties to overcome.

From MONTGOMERY, ALA. there are landing places to be found at COLUMBUS, GA., MACON, GA., AUGUSTA, GA., COLUMBIA, S. C., SUMTER, S. C. and DARLINGTON, S. C.

South Carolina is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

NAVAL and MILITARY AERONAUTICS

Commander Towers to Pensacola

Commander John H. Towers will arrive in Pensacola about the first of November, having been ordered by the navy department to the Pensacola Naval Air Station as executive officer, succeeding Lieutenant-Commander Paunac in that capacity. Commander Towers is now with the Pacific Fleet Air Squadron.

No official statement has been received from Washington as to the orders received by Lt-Com. Paunac, but it is stated unofficially that he will probably assume other duties at the naval air station.

Commander Towers was the first American aviator to make an official flight for the United States government, he having been sent to Vera Cruz to make maps of that country at the time of the trouble between Vera Cruz and the United States.

Later he was sent to England and it was while at the court of St. James that he met his wife, who is of English nobility. The wedding of Commander Towers to this daughter of an English Lord was an event of the season at Mayfair; and was widely chronicled.

Commander Towers received much of his training in England and he was the first head of the naval air training school at the time that Captain Mustin was in command at the station on its organization in 1914. After his training here he was much abroad and was one of the naval aviators to compete with Lt-Commander Albert Cushing Read and P. N. L. Bellinger in the first long distance flight across the Atlantic, which was won by Read.

In spite of his high social connections and the fact that he ranks as one of the greatest of aviators, Commander Towers is "Jack" Towers to the Pensacola friends he made during his residence, and old friends as well as officers of the navy and army will cordially welcome him to Pensacola.

Naval Air Stations on Peace Basis

Washington.—Organization of the naval air establishments on the Pacific coast on a peace basis has been undertaken by the navy department, with the transfer to San Diego of much of the equipment and personnel formerly stationed at Cape May, N. J., Chatham, Mass., and Rockaway, N. Y.

Strategic considerations led to concentration of most of the navy's air forces on the Atlantic seaboard during the war, officials said, but with the end of hostilities this necessity was removed. The three eastern stations recently closed because of lack of adequate operating funds.

Following the basic naval policy the intention of the department is to divide its aviation facilities equally between the two coasts.

The navy has five practical branches to its air service, two air fleet forces, one operating with each fleet; aid force bases at Hamoton Roads and San Diego, where the machines are repaired and supplied and the men trained; two territorial patrol stations at Coco Solo, Panama, and Pearl Harbor, Hawaii; a general training station at Pensacola, Florida, and an experimental station for the development of rigids at Lakehurst, N. J., which, however, is not an operating station.

The flying personnel of the navy now numbers approximately 6,065 pilots.

XBIA Aeroplanes to be Operated

The Commanding Officer of the San Antonio Air Intermediate Depot has received orders to set up immediately ten XBIA aeroplanes, which will be assigned to a squadron at Kelly Field to be designated by the Comanding General of the 8th Corps Area. This being the first time that this equipment is to be operated in the Air Service, special pains will be taken to see that the necessary detailed reports are secured, in order that an accurate historical record may be obtained and such other information gathered as may be of value to the Engineering Devision at McCook Field in the development of future equipment. Cross-country flights in this aeroplane will be prohibited until the necessary testing about the aerodrome has proven satisfactory.

The Blimp as an Observation Balloon

At the Army Balloon School at Ross Field, Arcadia, California, a second test was recently made of using a Pony Blimp as an observation balloon by means of attaching a cable. The Blimp was allowed to rise to a height of 1,000 feet and showed marked improvement over the initial trial as an observation balloon. The test clearly indicated that the motorized observation balloon has great possibilities. It is believed by many airship pilots that the Blimp will soon supplant the observation balloon, as it will be able to remain stationary over a given point by means of a cable. When it is desired to change position this may be done by hauling in the cable and flying to another point. Further tests will be made in the near future.

Completion of Flying Training at Post Field

What is perhaps the most thorough course of flying training yet accorded any class of student flyers in the history of the United States Air Service terminated at Post Field on Thursday, September 15th, when the summer term of the Air Service Observation School, which commenced on April 25th last, was brought to a close, with a total of 42 flying officer graduates, all of whom were at once reported to the academic board convened at this station as ready to be recommeneded for rating as aeroplane pilots. Eight field officers are included in the list of graduates.

Including time in the air as observers on practice tactical missions, the pilot books of the officers graduated show an average total of approximately 130 hours flying time which, when distributed over a period of but little over five months, gives a clearer idea of the amount of flying required of each student to complete the curriculum of advanced flying training at this school. The above figure is, of course, exclusive of flying time accumulated at primary Air Service schools, which will average about 70 hours for each pilot, giving a grand total of approximately 200 hours in the air before the student flyer was considered ready for the much coveted rating of aeroplane pilot.

A comparative value of the above figures, which helps to indicate that the ideal of peace time air training is thoroughness, may be obtained when it is remembered that, under the stress of war requirements, many pilots were operating successfully on the Western Front before they had gained a total air experience of as much as 50 hours, and in many cases, particularly in the Royal Air Force, 30 hours or even less would cover the total instruction and practice time of flying officers prior to their first trip over the lines, whilst the average useful life of a pilot in actual war service missions on the Western Front, measured in hours of flying time in contact with the enemy, was computed as considerably less than 100 hours.

Ten hours of formation practice in De-Haviland 4 Liberty machines was made a part of the advanced training curriculum for each pilot of the present class at Post Field, and a further idea of the thoroughness of practical flying experience gained by each of the present graduates before being reported as ready for rating is gained from the fact that the cross country training of the class as a whole involved a grand total of approximately 127,000 miles which, divided among the class of 42 student flyers, gives an average of over 3,000 miles for each pilot on cross country flying alone, all of which was carried out during the final month of the course. Several organized cross country flights, with formations in some instances including up to 15 machines, were flown by student officers to destinations varying in distance of from 200 to nearly 500 miles.

The numerous individual cross country missions involved were in almost every instance thoroughly successful, and served to demonstrate in the most practical way the ability of the student to navigate his course under all conditions of weather and varying terrain, operate from unfamiliar and often quite unfavorable fields, and to exercise practical resourcefulness in the care and repair of both ship and motor without assistance from the home station.

Meteorological Station at Carlstrom Field

The Signal Corps is establishing a meteorological station at Carlstrom Field, and Sergeant John M. McClelland has been sent to this station to have charge of this work. The various instruments and implements are already on hand and are being set up under Sergeant McClelland's direction. The station is located at the Old North Gate, and the guard house there is being used in connection with the work.

FOREIGN NEWS

An Air Ambulance

Recently one of the Continental air expresses was converted into an ambulance for a woman patient traveling with a nurse from London to Paris to undergo an urgent operation. The woman, after being taken to the air station in a motor car, was carried in an invalid chair and lifted into the saloon of the aeroplane, which had been specially prepared for her.

Ringing Up a Plane

The entire British fleet of air expresses in regular use between London and Paris is now equipped with wireless telephones, and during their aerial journeys the machines are in constant communication with the ground stations.

It is no uncommon thing to hear while "listening in" at a ground station the pilot of an incoming air express speaking to the pilot of an outgoing machine and advising him of peculiarities of the weather along the route. The enterprise of British air transport firms in this matter is illustrated by the fact that foreign machines using the London air port, although outnumbering the British by nearly 2 to 1, do not use wireless. In fact, on only one foreign machine has any attempt been made to provide this necessary facility.

Appropriations by Italian Government for Civil and Military Aviation

For the fiscal year ending June 30, 1922, the Italian Government has appropriated 42,700,000 lire for the Army Air Service and 22,060,000 lire for Civil Air Service, both services being under the jurisdiction of the War Department.

With regard to the appropriation for military aviation, the largest sum is allotted for the renewal of aviation material (16,500,000 lire). Next in order is 13,000,000 lire for gasoline, oils, etc. For expenses incidental to the preparation of flying personnel 4,800,000 lire is allotted; maintenance of buildings and aerodromes 2,200,000 lire; special compensation to flying personnel, 2,400,000 lire; conducting experiments of aircraft and aircraft armament, 2,050,000 lire; repair and maintenance of planes, motors, and other material, 1,300,000 lire; aerial photography, 150,000 lire; and miscellaneous expenditures, 300,000 lire.

Of the appropriation for civil aviation, 4,500,000 lire is allotted as subsidies to private aeronautical concerns for the operation of airdromes and aerial routes by heavier-than-air and lighter-than-air craft; 2,300,000 lire for carrying out studies and experiments; 3,000,000 lire for construction purposes; 2,460,000 lire for the operation of a preliminary flying school; and the remaining 7,200,000 for miscellaneous purposes. An additional appropriation, not yet determined, is to be allowed the Civil Air Service for the construction of commercial aeroplanes.

The salaries of army personnel are paid out of other appropriations for the support of the Army. Many of the aerodromes are also supported from funds appropriated for the maintenance of army posts. It is estimated that the Army and Civil Air Services receive from other appropriations to cover various services such as maintenance of posts, pay of the army, etc., 50,000,000 lire, making a total sum to be expended for military and commercial aviation in Italy during this fiscal year of approximately 112,760,000 lire, or slightly over $28,000,000.

Altitude Record by Uruguayan Officer

A dispatch from Uruguay is to the effect that the Uruguayan military aviator, Captain Larre Borges, with two passengers, attained an altitude of 6,700 metres (21,981 feet), being forced to descend from that height because of lack of oxygen.

S.V.A.'s in Ecuador

Two S.V.A. 130 horsepower planes with a speed of 140 kilometers have been imported from Italy and presented to the Ecuadorian Government by the University Patriotic Club and the Syrian Colony. There are now seven planes in the government service and one more is promised by the Chinese Colony. The National Government has contracted with an Italian manufacturer to furnish 12 aeroplanes with the equipment for repair shops. The Bank of Ecuador and the Commercial and Agricultural Bank have each contributed 15,000 sucres toward the Government aviation field across the river from Guayaquil. The total subscription for the field exceeds 50,000 sucres (approximately $25,000).

Touring Europe by Air

The following brief account of the tour of Europe made by a machine hired from the de Haviland Hire Department, which appears in *Flight*, is of considerable interest, not only on account of a very good performance, but equally because of the information concerning the various landing grounds, etc., of which the travelers had experience. When it is remembered that the total distance covered was about 4,500 miles, and that not a wire was broken or a mishap of any kind occurred, this brief and modest account by the pilot, Mr. A. J. Cobham, throws a strong light on the reliability of modern air travel.

This trip was carried out on a standard D.H. 9 four-seater machine (piloted by Mr. A. J. Cobham) hired by two business men as the best and cheapest method of visiting the principal towns of Europe. In all 17 towns were visited and 4,500 miles covered in three weeks, or 56 hours' flying time, the program being so arranged that the flying was usually done between lunch and dinner, leaving the evenings free for social engagements and the mornings for business purposes. On a journey of this magnitude many interesting and amusing episodes naturally occurred, but it has been thought best to confine this account to an itinerary of the ground covered, with such details added as are likely to be of use to those covering the same ground, or which are of general aeronautical interest.

August 24.—*Stag Lane-Lympne,* 80 *miles. Time,* 1 *hr.*

It was impossible to get further that day, owing to dense fog in the Channel.

August 25.—*Lympne-Paris,* 170 *miles. Time,* 2 *hrs.*

August 26.—*Paris-Brussels,* 170 *miles. Time,* 2 *hrs.* 5 *mins. Brussels-Amsterdam,* 120 *miles. Time,* 1 *hr.* 20 *mins.*

At Brussels the Aerodrome is just north-east of the town, and quite close in. The approach is good, but the surface poor. The Amsterdam Aerodrome is good, with plenty of accommodation and a first-class hotel. The K.L.M. Co. are evidently anticipating some big business, and are ably assisted by the Dutch Government, which has even given them a plot of land in the center of the town to erect a booking office.

August 27.—*Amsterdam-Bremen,* 180 *miles. Time,* 2 *hrs.* 30 *mins. Bremen-Hamburg,* 70 *miles. Time,* 1 *hr.*

The stop at Bremen was for customs only. At Hamburg the landing ground is the old Zeppelin Aerodrome. The surface is bad at present, but the authorities talk of making this the finest aerodrome in Germany when the program they have in contemplation materializes. The only petrol obtainable was of poor quality, and the engine revs. suffered in consequence.

August 28.—*Hamburg-Copenhagen,* 200 *miles. Time,* 2 *hrs.* 30 *mins.*

Here the aerodrome is right in the center of the town, but unfortunately there is a prospect of it being changed, as the present site is required for building purposes. By reason of its position as the Scandinavian link with the Continent, Copenhagen should become a big commercial aviation center connecting both Stockholm and Christiania with Hamburg and Rotterdam, and thence by sea or air with London.

September 1.—*Copenhagen-Stockholm,* 350 *miles. Time,* 3 *hrs.* 55 *mins.*

Three days were spent in Copenhagen, and then the journey was resumed to Stockholm. Owing to the hilly and mountainous nature of this region, it is very difficult flying country, though extremely picturesque seen from above. The first half of the journey offers no possible landing place, but after that, the lakes would afford a landing place for seaplanes, or in winter, when they are frozen over, to aeroplanes fitted with skiis. At Stockholm a landing was made at Hagerstahand Aerodrome, about 15 km. north-west of the town. No accommodation exists at present, and the surface is not very good, but work is in hand to put this right.

September 3.—*Stockholm-Örebro,* 110 *miles. Time,* 1 *hr.* 45 *mins. Orebro—Christiania,* 180 *miles. Time,* 2 *hrs.* 20 *mins.*

The next stage was to Christiania, but *en route* a stop was made at Orebro, where Capt. Saunders, who has been flying in Sweden for the last two years, was giving an exhibition on an Avro. After a short stay the journey was continued against a strong head wind, following the railway track to Manger, and thence on a compass course due west to Keller, over a mountainous trackless waste, with no possibility of landing, and no sign of any habitation. The landing was made at Keller Military Aerodrome, in the heart of the hills. This Aerodrome is quite large and level, but the surface is a bit heavy.

September 4.—*Christiania-Copenhagen,* 350 *miles. Time,* 3 *hrs.* 40 *mins.*

From Christiania to Gottenburg there are no landing grounds, but at the latter place what looks to be a fairly good landing ground exists. A landing was made in a field at Helsingborg owing to low cloud, storm and rain, but after a 50-min. wait, conditions improved sufficiently to enable the flight to be continued over the sea to Copenhagen at about 50 ft. above the water.

September 5.—*Copenhagen-Berlin,* 240 *miles. Time,* 3 *hrs.* 20 *mins.*

The short sea route, *via* Schwerin, was followed, and a landing made at the Aerodrome (now quite good) due west of Berlin in the fork of the main lines. Every courtesy was extended by the aviation authorities, but the only petrol obtainable was very poor and heavy, and again the engine revs. suffered.

September 7.—*Berlin-Warsaw,* 350 *miles. Time,* 3 *hrs.* 40 *mins.*

The Aerodrome at Warsaw is good and close to the town, but as no sort of accommodation was procurable, the party had to spend the night in the Turkish Baths! Here a delay occurred in the resumption of the flight owing to the Aerodrome Commandant being *en fête,* and until his return on the next morning the machine was not allowed to proceed, being guarded meanwhile by a cordon of Polish troops.

September 9.—*Warsaw-Prague,* 350 *miles. Time,* 3 *hrs.* 40 *mins.*

The Aerodrome at Prague is both military and civil, and every accommodation exists, and all help was gladly given.

September 10.—*Prague-Vienna,* 180 *miles. Time,* 2 *hrs.* 40 *mins.*

The Aerodrome at Vienna is good, but runs in ridges from north to south. The travelers were very well treated, but found the petrol dirty and mixed with water.

September 11.—*Vienna-Klagenfurt,* 140 *miles. Time,* 2 *hrs.*

Owing to the Austria-Hungary hostilities it was decided to go to Venice not *via* Gratz, but down the valley to Klagenfurt. This involved flying down a narrow valley at a height of 5,000 ft. with mountains towering 8,000 ft. above. As soon after leaving Vienna, one magneto cut out, it was decided to land at Klagenfurt. The Aerodrome is quite good and very large, with a fair surface except near the hangars.

September 12.—*Klagenfurt-Venice,* 160 *miles. Time,* 2 *hrs.* 20 *mins.*

As the Aerodrome at Klagenfurt is 2,000 ft. above sea level, the start planned for 11 a. m. had to be postponed till the afternoon, with a load of 600 lbs., plus pilot and fuel, the machine would not unstick. The flight onward embraced several very narrow valleys, with the clouds at times so low overhead as to give one the impression of flying down a tunnel. The landing was made at the Lido Military Aerodrome, near Venice, where every courtesy was received from the Italian officers.

September 13.—*Venice-Brescia.* 100 *miles. Time,* 1 *hr.* 20 *mins.*

No petrol being procurable in Venice, an Italian officer kindly volunteered to accompany the machine to Brescia, in order that there should be no difficulties with the authorities. This meant increasing the load of the machine by another 150 lbs., but with the help of a steep concrete gradient, the get-off was effected. The machine landed at the Ghedi Aerodrome, and it being too late to continue that evening, the Italian officers did their best to entertain the travelers. So well did they succeed that the only untoward incident of the trip occurred, a most enjoyable motor-car drive by moonlight, culminating in the whole party being upset in a ditch at 50 m.p.h., fortunately without serious accident.

September 14.—*Brescia-Milan,* 60 *miles. Time,* 50 *mins. Milan-Nimes,* 280 *miles. Time,* 4 *hrs.* 20 *mins.*

The route followed was *via* Genoa and then along the Mediterranean to Nice, so that the full beauty of this coast was seen. Between Genoa and Nice there is hardly any possible landing ground. There are two or three spots where one might get down, but not off again. The Aerodrome at Nimes is quite good, but a sharp lookout must be kept for pupils from the flying school on solo flights.

September 15.—*Nimes-Paris,* 390 *miles. Time,* 4 *hrs.* 40 *mins.*

September 16.—*Paris-Stag Lane,* 270 *miles. Time,* 3 *hrs.*

This completed what is probably the longest business trip by air yet undertaken.



Mummert Sport Plane Flown at Curtiss Field

ONE of the most interesting aeroplanes exhibited at the Aero Club's "Field Day" at Curtiss Field on October 16th was the little Mummert Sport Plane described in these columns recently. During the day the machine was parked out among the bigger planes, where its remarkable contrast in size, especially when the big Remmington-Buranelli 30-passenger plane was near, caused much speculation on the part of strangers who wondered if it could really fly.

It was not until just before dark that Bert Acosta had the opportunity to take the Mummert plane up; Acosta had been flying continuously all day, mostly the old 1910 Curtiss pusher exhibition plane and the new Fokker monoplane which carries six passengers. Mr. Mummert was on hand to tune his machine up, and the engine was working satisfactorily.

After removing his boots, to the wonderment and laughter of the crowd which closed in around the plane, Acosta slid into the fuselage. A good deal of persuasion was necessary to clear the way for the machine to take off, so eager was the crowd to carefully observe the preparations for flight. As the engine is an air-cooled type (Lawrence 2-cylinder) no "warming-up" was necessary, and after a few minutes to make sure it was functioning properly, the plane taxied off, gathered speed and took off in the finest form. A couple of circles were made of the field, the machine exhibiting perfect control and unusual speed. The speed appeared to observers to be between 90 and 100 miles an hour, and the altitude about 500 feet.

In landing, the machine soared in a flat glide for quite a distance before the wheels touched. The machine turned and taxied back to the starting point. By that time it was growing dark and the flames from the exhaust ports of the engine were visible even before the machine could be discerned as it approached the waiting crowd. The spectators seemed satisfied to regard this flight as a fitting conclusion to one of the finest "Aerial Field Days" New York has witnessed in years.

Impromptu Reunion of Model Flyers

The flying exhibition at Curtiss Field on October 16th proved to be an attraction for a great number of young men who formerly belonged to Model clubs in and near New York. Many of the old model flyers who were ardent followers of the sport many years ago met and renewed acquaintances. A good many of the former model flyers are now engaged in various branches of the aircraft business, as pilots, designers, mechanicians, etc.

The Laird "Swallow," a 3-passenger plane which was flown from Kansas, was piloted by "Buck" Weaver, one of the most popular of the "old" model enthusiasts. His clever flying was a treat, for he has all the tricks of the trade and knows how to behave in the air. John Carisi, associate with Buranelli in the construction of the "A.B.C." pusher, flown by Bjorkland in the pre-war days, was a skillful builder of models, as was Vincent J. Buranelli, his former partner. Carisi and Buranelli were also with Lawson when the "Air Liners" were produced. Carisi is at present with the Wittemann-Lewis Co.

Vincent Buranelli was chief designer for the Nebraska Aircraft Co., designed the Continental Pusher at Capague, L. I., and recently designed the Remmington-Buranelli 30 passenger machine. He made several flights during the day.

Some of the other model flyers who were met on the field were: Russell Holdermann, pilot; George A. Page, formerly pilot for the Trans-Oceanic Co.'s twin-motored boat called "The Big Fish," which plys between Florida and Cuba during the winter, now in the aircraft department of the Ordnance Engineering Corporation; Louis Fenouillet, mechanician; Rudolph Funk, designer, now with the Lawrence Sperry Co.; George F. McLaughlin, designer, Ordnance Engineering Corporation; Andrew Surini, mechanician—"one of the few who can swing the propeller of a Liberty Engine"; Frank Shober, now with Cox-Klemins, and known for his compressed-air engines. Shober has been regarded as one of the neatest model-builders, being able to carry out the greatest of detail and finest finish on every model he built. He has many records to his credit. Lee Wallace, an early pilot and designer, is well known among the members of the old New York Aero Science Club and the Aeronautical Society. Walter H. Phipps, of the Ordnance Engineering Corporation, is another ex-member of the Aero Science Club. Although he has designed a number of successful planes (the latest being the "Orenco" Type F-4, 4-passenger plane which is just completed) in the many years he has been active in the game, his interest in models continues. Broadfield Billings, an expert model flyer at Van Cortlandt Park years ago and now a professional designer of models, and inventor of the "Broadfield" line of model aeroplanes. Other model flyers, whose names cannot at this moment be recalled, appeared and talked over old times.

Some of the newer model flyers, whose names are familiar to AERIAL AGE readers; are W. F. Shult (whose hydro-model was described last February), now with "Orenco"; and Bruce A. Mapes, whose many fine models are admired by readers of the Elementary Aeronautics Page.

Page and Fenouillet made flights with Weaver. Buranelli flew with Eddie Stinson in the Remmington-Buranelli plane. Funk and Phipps flew in the Sperry monoplane. Mr. Dickenson, who is 78 years "young," accompanied Weaver in his flight from the West. Mr. Dickenson is a member of the Illinois Model Aero Club, having given the club his valued support and assistance in many ways. Incidentally, Mr. Dickenson is one of the oldest pilots in the country and capable of handling a plane without the least difficulty.

S. E. V. Model Built by W. G. Eldridge, Jr.

Below is shown a nicely proportioned scale model of the S. E. V. Scout biplane, made by Willard G. Eldridge, Jr., of Washington, D. C. This model was constructed to plans published in AERIAL AGE on July 8th, 1918. and the drawings published on the model page November 29th, 1920.

Care was taken to make this model as nearly correct in all details to make an accurate reproduction of the S. E. V. as used by the British and American air forces during the war.

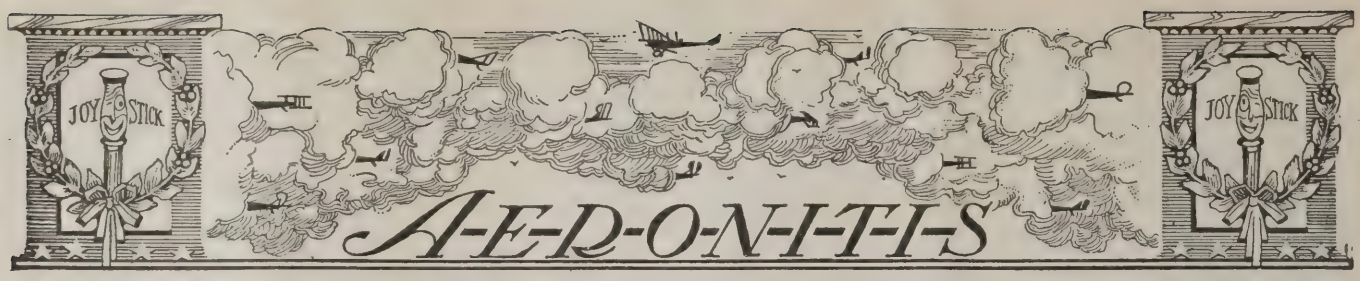
The fuselage is made of veneer and built up of wood members in a manner similar to the real machine; that is, veneer extends from the radiator to the pilot's cockpit. The rear of the body is covered with bamboo paper. A radiator is mounted in front, with shutters. The imitation Hispano engine is cowled over with aluminum hoods. A machine gun is mounted on the top wing.

One gross (144) wood screws were used to attach fittings, making the machine rather heavy for flying, although it glides perfectly.

Mr. Eldridge will be glad to hear from any fellow engaged in building models or one interested in the discussion of aeronautics. Address, 542 Irving Street, N. W., Washington, D.C.



SE-V Scout Model with a 39-inch wing span. Built by Willard G. Eldridge, Jr., from Aerial Age plan



The Air Racing

(With apologies to Mr. Kipling.)

When the last of the races is ended,
  And the tanks are all emptied and dried;
When the cuts and the bruises have mended,
  And the serious cases have died—
We shall rest, and faith, we shall need it—
  Do nought for a month or two,
Till the people—seeking amusement—
  Shall put us to race anew.

And the pilots that win shall be happy
  For, passing the Judges' tent,
They shall spin and roll and side-slip,
  And loop to their hearts' content;
They can do as they like for the moment;
  They can glide or crash or fall;
Or can turn their noses upwards,
  And never come down at all.

And most of the people will praise them,
  Though some of the people will blame,
Saying they do it for money,
  Saying they do it for fame.
Yet—each for the joy of the flying,
  And each in his separate way,
Will put all his best in his racing
  To make a success of the day.

—*J. M. Q. in The Aeroplane.*

On High

By Contact.

To John A. Macready, Holder of World's Altitude Record.

With a steady deepened roar,
Louder yet becomes the sound,
Over the smooth and earthy floor
The man-bird speeds and leaves the ground.

Up, up farther he flew,
'Til lost completely from our sight,
Far in the sea of fathomless blue
He cruised fair skies at an unknown height.

The "Liberty" with its faithful song
Resounds and echoes thruout the sky,
Carrying plane and pilot swiftly along,
To uncharted ways on high.

Up, 'til no further can he go,
So down he glides in open space,
Down to the welcome ground below,
To greet the earth's bright shining face.

Coasting down from where he came,
Down from his greatest height,
To add more honor to his name,
On this record-breaking flight.

So will man strive to conquer the sky,
Intrepid men with frail linen wings,
Will soar with winged steeds on high,
To rise above the lower things.

The Economics prof. was waxing warm on the topic of Supply and Demand. Singling out an unappreciative, he asked: "Mr. Dash, give me an example of an elastic demand."

Mr. Sprint—"A pair of garters."

—*Orange Peel.*

"Why was Miss Calculation sent home from college?"
"She went with too many men to the shows."
"What of that?"
"She was making fraudulent use of the males."

From Our Cynical Bachelor

An evening spent at a mixed bridge party makes a man appreciate the poker session at the club.

The fellow that forgets to get up for graduation will probably go to sleep at his own wedding.

Can it be possible that the predominance of bobbed hair is due to a cheapness of upkeep.

The beauty spot has caused the loss of more heads than the guillotine. —*Wisconsin Octopus.*

A Romance

He saw her on the campus
And liked the way she walked.
He spoke to her on the side walk
And liked the way she talked,
He tried her at a party
And liked the way she danced.
He took her out to dinner
And came away entranced.
He went to church on Sunday
And listened to her sing.
He took her for a car ride
And how that girl did ——,
Well anyway he liked her
And she grew fond of him
And now beneath her ? ? ?
She wears his ? pin.

"So the doctor told you to go to a warmer climate. What was the nature of the trouble you consulted him about?"

"I went there to collect a bill."—*Michigan Public Health.*

First Stenog. (reading)—"Think of those Spaniards going 3000 miles on a galleon!"

Second Stenog.—"Aw, forget it. Yuh can't believe all yuh hear about them foreign cars."—*N. Y. American.*

The Regulation Blues

Before I joined my hair was long
  And was my pride and joy;
In fact, the girls would stroke my locks
  And call me "pretty boy."

They simply made a fool of me,
  And I had lots of fun,
Now if they see me coming,
  Those same girls start to run.

Or tell me I may wear my hat;
  Some even say "good night!"
"Where did you get that hair-cut?
  You surely are a sight."

And then they count my knowledge bumps,
  Dog-gone, but I get blue!
And say it's regulation—
  That's all a gob can do.

—*A. R. D.*

"I had a swell bun on last night."
"Lucky stiff! How'd you get the hooch?"
"Won five prescriptions in a poker game."

Keep Moving

Some visitors were standing in a Glasgow street, gazing at certain points of interest.

"Come now," said a policeman, "move on there. You're blocking up the path."

"I thought this was a free country," said one of the party.

"Aye, but ye're in the toon the noo," replied the policeman, "and if ye'll be wanting to be standing there, ye must be walking aboot!"—*London Ideas.*

The Poet

I loathe him.
I am a beautiful woman . . .

The title of the love sonnet was: "Lines on Eleanor's Face."—*Black and Blue Jay.*

Klauder—"I almost married a shimmie dancer."
Kafka—"What then prevented the marriage?"
Klauder—"Oh, she just wiggled out of it."

BOOK OPPORTUNITY

Through a special arrangement we are enabled to offer to our readers the following books at an unusually low price.

The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid **$2.25.**

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various type of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot."

Map Reading for Aviators

This concise book by C. B. Benson, C. E., formerly instructor in Cornell University School of Military Aeronautics, is one which every pilot should have. It discusses maps, map scales, conventional signs, form of the ground, direction, and preparation of maps. There is also an interesting chapter on aerial navigation. Price, postpaid, **60 cents.**

Aeroplane Construction and Operation

This book by John B. Rathbun is regarded as one of the best illustrated manuals for aeroplane instructors, aviators, aero-mechanics, and students, and is adapted for either school or home study. It provides 400 pages of excellent material. Postpaid **$1.10.**

Book Department

AERIAL AGE WEEKLY

280 MADISON AVE. NEW YORK

AIRPLANE PARTS AND ACCESSORIES

Johnson Airplane and Supply Company

DAYTON, OHIO

New and used Curtiss Motors; also used Beardmore and Hispano Motors in excellent condition, all at bottom prices.

New 26 x 4 wheels with streamline	$10.00
New 26 x 4 Goodyear casings	10.00
New Goodyear tubes	2.50
New 30 x 5 wheels	3.00
New 30 x 5 casings	10.00
New 26 x 4 Ackerman Spring wheels	20.00
New casing and tube for same	15.00
Brass olive joint for gas line (Prevents gasoline from touching nose)	.10
Oil gauges, 50 to 60 lbs.	3.00
Air gauges, 10 #	2.50
Water temperature gauges with radiator connection	6.00
Champion spark plugs	.75
Dixie 2-magneto switches	5.00
Hand air pumps	5.00
Hand gasoline pumps	10.00
Gas strainer and copper gas line	2.50
3-way gas valves for gasoline or air line	5.00
No. 18 copper safety wire, 100 foot spool	1.00
Standard dual controls	10.00
Standard vertical radiators	20.00
Standard leather cushions	1.50
Standard axles	2.50
Standard longerons	5.00
Linen covers for all surfaces	

Titanine clear dope and pigmented dope in all colors. We carry a varying stock of spares for all makes of planes and motors.

We have Standard, Dee, and Canuck planes ready to fly. We also rebuild these planes to carry any motor desired.

Write for our Price List

(*Concluded from page* 176)

that will be made in the future by aircraft, on May 10th, 1921, The World's Board of Aeronautical Commissioners, Inc., mailed from their New York office four letters as follows:

A—Westward, via New Zealand and England.
B—Westward, via Japan, Ceylon and England.
C—Eastward, via England and New Zealand.
D—Eastward, via England, Ceylon and Japan.

The letters were remailed by the Commissioners of the Board, the Hon. Sir R. Heaton Rhoades in New Zealand, the Hon. B. F. Leefe in Ceylon, Sir George Fisher-Smith in England and Mr. E. W. Frazar in Japan.

	Days	*Hours*
The Eastward letter "D" via England, Ceylon and Japan arrived in New York, October 17th, 1921, but the remailing was delayed in Ceylon, owing to the absence of the Commissioner, 71 days. Deducting this delay and the journey would have been made in	89	2136
The two Westward letters (A-B) arrived in New York same time	104	2496
The second letter Eastward, via Japan, Ceylon and England required	111	2664
Estimated time required by aircraft to make a flight around the world via Alaska, Aleutian Islands, Japan, China, Burma, India, Persia, Greece, Italy, England and Newfoundland (22,207 miles)		300

A—Westward via New Zealand and England.

Mailed	*Date*	*Arrived*	*Date*
New York	May 10	Wellington, N. Z.	July 16
Wellington, N. Z.	July 16	Halifax, England	Aug. 10
Halifax, England	Aug 10	New York	Aug. 22

Time—Days, 104; *Hours,* 2496.

B—Westward via Japan, Ceylon and England.

Mailed	*Date*	*Arrived*	*Date*
New York	May 10	Tokyo, Japan	June 10
Tokyo, Japan	June 10	Colombo, Ceylon	July 8
Colombo, Ceylon	July 9	Halifax, England	Aug. 6
Halifax, England	Aug 8	New York	Aug. 22

(No mail Sunday)

Time—Days, 104; *Hours,* 2496.

C—Eastward via England and New Zealand.

Mailed	*Date*	*Arrived*	*Date*
New York	May 10	Halifax, England	May 23
Halifax, England	May 23	Wellington, N. Z.	July 14
Wellington, N. Z.	July 14	New York	Aug. 29

Time—Days, 111; *Hours,* 2664.

D—Eastward via England, Ceylon and Japan.

Mailed	*Date*	*Arrived*	*Date*
New York	May 10	Halifax, England	May 23
Halifax, England	May 24	Colombo, Ceylon	June 15
Colombo, Ceylon	Aug. 25	Tokyo, Japan	Sept. 27
Tokyo, Japan	Sept. 27	New York	Oct. 17

Time—deducting delay (71 days), owing to abscence of Commissioner at Ceylon.—Days, 89; *Hours,* 2136.

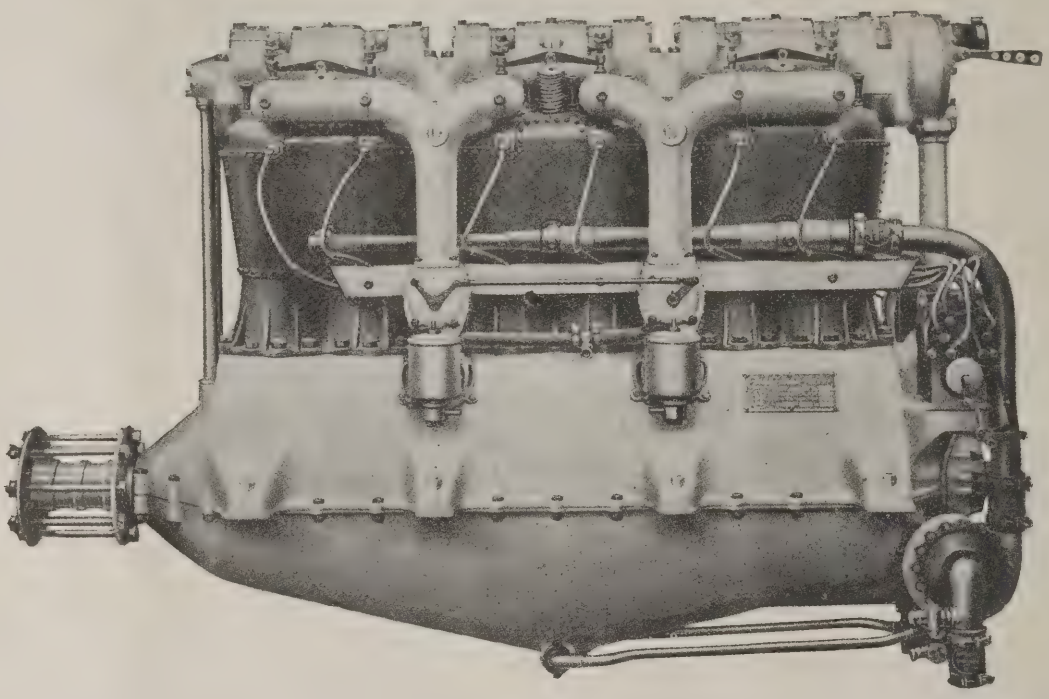
(*Concluded from page* 180)

$s = 140$ mm., $i = 11$, hence $v_h = 18.6\ l$, $\epsilon = 5$ and $n = 900 + 900$ r.p.m., gives a power of $N_e = 160$ HP up to about 3500 m. altitude, with a fuel consumption of about 274 g/HP-hr. (in agreement with the HP adopted by Adlershof for the S-H III Engine No. 9807 on July 2, 1918).

Taken together, the examples show a remarkably satisfactory agreement with practical results. In all cases the deviations are less than 5%, which is only a reasonable allowance.

Summary

We have developed a simple fundamental formula for the preliminary calculation of cylinder dimensions on the basis of the air requirement of the fuel for the various efficiencies. For the various engine types we have given the pertinent values of the efficiencies, together with the required stroke volume for some particular engine of each type, in which there is very good agreement with the engines specified. Equally good agreement has been established between the calculated fuel consumption and that found by actual experiments.



The most suitable engine available for installation in Standard J-1 planes. Easiest to install—greatest reliability. Lowest price for complete new motor. List price. . . . **$950.00**
Good for 250 hours without major overhauling if properly cared for.

AERO DISTRIBUTING COMPANY

17 East 42nd Street *Room 419* New York City, N. Y.

ECONOMY

IS NOT JUST A QUESTION OF LOW FIRST COST
BUT ALSO
LONG SERVICE and RELIABILITY

USE

TITANINE

TRADE MARK

DOPES and COVERING MATERIALS
MADE BY

TITANINE Inc.

Morris & Elmwood Aves. Union, Union County, N. J.

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

PHILADELPHIA AERO-SERVICE CORPORATION

636 Real Estate Trust Bldg. Philadelphia

NOW AVAILABLE FOR YOUR AUTO

"The Plug That Cleans Itself"

Saves Gas **B-G** More Power

GUARANTEED CARBON AND OIL PROOF

Recognized as the best for aeroplanes,
its success for automobiles is assured

B - G CORPORATION

33 Gold St., New York

If your dealer cannot supply you, send us his name and $1.00 for each plug, stating name and year of manufacture of your car.

CANUCK and OX5 SUPPLIES

Complete assortment at lowest prices
Recover your Canuck during winter months

1 Set (4) wing covers (cotton) with tape and dope. . . . $69.00
2 Upper wing covers (cotton) with tape and dope. . . . 45.00
2 Lower wing covers (cotton or linen) with tape and dope 38.00
Single covers Upper $15.00 Lower $14.00
Acetate dope per gal. $1.00

Other material and parts at correspondingly low prices

AIRCRAFT MATERIALS & EQUIPMENT CORP.
1409 Sedgwick Avenue, N. Y. C.

THE De Luxe Air Service, Inc., can store several machines for the winter at reasonable rates in its large hangar at Deal, N. J. It is also able to undertake repairs on Canucks or "D's", or furnish parts for these machines and OX5 or OXX motors at interesting figures. Get our new price list, or our quotations on any of above jobs.

DE LUXE AIR SERVICE, INC., Asbury Park, N. J.

AERIAL AGE WEEKLY

VOL. 14. No. 9 NOVEMBER 7, 1921 10 CENTS A COPY

NOV 1921



Airscape of Columbia University District Photographed for the Fairchild Aerial Camera Corp. by W. L. Hamilton

The JL-12 Attack Plane—The Orenco F 4 Tourister—Helium for Airships

UBLISHED WEEKLY BY THE AERIAL AGE W., INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
ubscriptions: Domestic, $4; Foreign, $6. Ent d-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

MADE IN ITALY—USED THROUGHOUT THE WORLD

Ansaldo S. V. A. Aeroplanes

Reliability—Speed—Economy

AMERICAN ANSALDO ACHIEVEMENTS

NOVEMBER, 1920—THIRD PLACE, PULITZER RACE.
(A1 Balilla—130 miles 51 minutes 57 seconds)

MAY, 1921—NEW YORK-CHICAGO, 765 MILES, 7½ HOURS.
(A300C Limousine with full load)

JULY, 1921—NEW YORK-CLEVELAND NON-STOP, 4 HOURS.

CLEVELAND-CHICAGO NON-STOP, 3.1 HOURS.

AUGUST, 1921—NEW YORK-SAN FRANCISCO, 4½ DAYS.
Transcontinental made in 34 hours total motor time and
28 hours flight between points.

SEE ANSALDO AEROPLANES AT OMAHA

At our present prices we are offering values which have never been approached in the history of aeronautics. All prices include dual instruction at our field.

SVA Model Nine—two place	**$4,900.00**
Model A300-3—three place	**$7,500.00**
Model A300C—six place	**$11,000.00**

F.O.B. New York.

A Demonstration Will Convince You

AERO IMPORT CORPORATION

1819 BROADWAY **NEW YORK**

WRIGHT PATENTS LICENSEE

November 7, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 9

TABLE OF CONTENTS

Standardization in Aeroplane Design 195
The News of the Week..... 196
United States Post Office Department Air Mail Service..... 197
The Aircraft Trade Review..... 198
The JL-12 Attack Plane..... 199
New Orenco Type F-4 Proves Great Success 200
The Resistance of Aerofoils..... 201
Helium for Airships..... 203
Information for Pilots Giving the Practical Characteristics of the Land Along Various Air Routes. 204
Aero Club of Pennsylvania..... 206
Naval and Military Aeronautics... 207
Foreign News 208
Elementary Aeronautics and Model Notes 209
Aeronitis 210

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

COX KLEMIN AIRCRAFT CORP.

Consulting, Designing and Constructing Engineers

COLLEGE POINT, L. I.

Telephones Flushing 3682-J
Flushing 1800

FOR IMMEDIATE DELIVERY. CAN BE INSPECTED IN OUR SHOPS

STANDARD-MERCEDES

Brand-new, three place Standard with New Mercedes motor. Motor is rated at 160 h.p. and develops close to 200 h.p. Reports of pilot show perfect balance, great speed and climb. Completely equipped with instruments, and finished in every detail.

Price F. O. B. Factory..... **$3500.00**

D.H.-6 BENZ

New D.H.-6 with new Benz. The Benz six cylinder motor is rated at 120 h.p. and delivers 150 h.p. The combination makes a real two or three seater, which is in a class by itself as regards performance, general flying qualities and price.

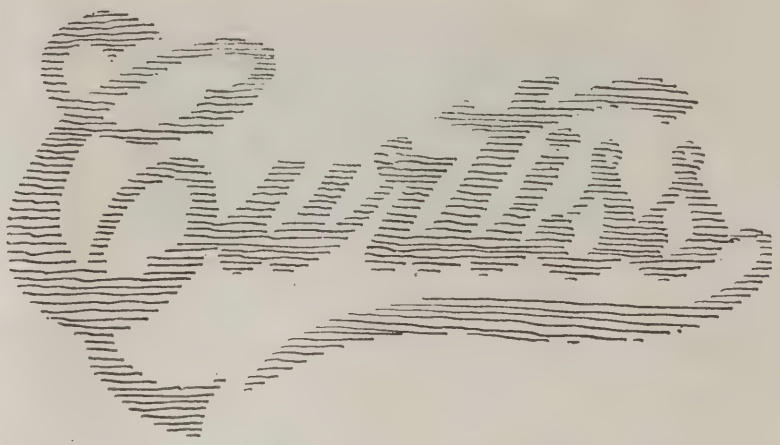
Price F. O. B. Factory..... **$2250.00**

MOTORS

Mercedes, Benz, and Isotta-Fraschini's at reasonable prices.

AIRCRAFT MATERIALS and accessories.

Write for prices and specifications. ALL inquiries promptly dealt with. Write in and state your requirements.



Announcing Reduction of Price List

EFFECTIVE FROM

November 1, 1921, to December 31, 1921

NEW PRODUCTION

	LIST PRICE	
'ORIOLE'		
With OX5 Motor	**$3000.00**	F.O.B. Buffalo, New York
With K-6 Motor (1919)	**4400.00**	F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	**4800.00**	F.O.B. Buffalo, New York
'SEAGULL'		
1919 K-6 Motor, dual stick control	**5200.00**	F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	**5600.00**	F.O.B. Garden City, L. I.
'STANDARD'		
With C-6 or K-6 Motor	**3600.00**	F.O.B. Garden City, L. I.
'MOTORS'		
C-6 or K-6 (150 H.P.)	**3000.00**	F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

'JN's'		
JN4D with new OX5 Motor	**$2400.00**	F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	**$1200 to 2200.00**	F.O.B. Dallas, Texas
'STANDARDS'		
With new OX5 Motor	**2000.00**	F.O.B. Houston, Texas
With overhauled OX5 Motor	**1700.00**	F.O.B. Houston, Texas
Without motor, rebuilt for OX5	**1100.00**	F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	**1600.00**	F.O.B. Garden City, L. I.
Without motor, as received from Government	**800.00**	F.O.B. Houston, Texas
'MOTORS'		
OX5 New	**800.00**	F.O.B. Various concentration fields
OX5 Overhauled	**600.00**	F.O.B. Various concentration fields
OX5 As received from Government	**500.00**	F.O.B. Various concentration fields

NOTE: Where delivery made from other than F.O.B. points accrued transportation charges must be added. Please consult our distributor or dealer or corporation direct for detailed information.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., November 7, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, NOVEMBER 7, 1921 NO. 9

STANDARDIZATION IN AEROPLANE DESIGN

IN last week's issue the question of the standardization of semi-raw materials, such as tubing, sheet and plywood was brought up. Such standardization is basic and would do much to improve aeroplane design in this country. But the work of standardization can, with tremendous advantage, be carried much further, into the realm in which many designers jealously feel it has no place. They are inconsistent, however, for who among them would design a special wheel or tire for an ordinary aeroplane instead of selecting one from among the standard sizes? Yet why should not control masts for rudders, elevators, and ailerons be standardized just as well as wheels? Entirely too much time is being spent in redesigning for every new job scores of parts that it should be possible to select from stock catalogues.

On several occasions, the writer has talked to other engineers on this subject of standardization, things that should be standardized and methods for doing it. One of the great services that McCook Field can render the aeroplane industry is to take up this work. No other institution can effectively handle the problem, and it is entirely beyond the scope of any private organization. If the standards established are to endure, they must be the result of painstaking efforts of several engineers. In this way, by the pooling of ideas and the elimination of all but the best, standards can be evolved which will be far superior to the efforts of any one designer.

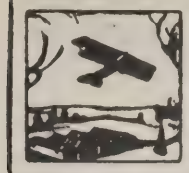
In the design of standard parts, several factors must be given careful consideration. Among these, weight is one of the most important. Far too much weight is being carried around on most aeroplanes in the form of non-structural details. So in standardizing a part or series of parts, the questions must be asked, can duralumin be used instead of steel, and can any more material be cut off without jeopardizing the strength of the piece? Obviously sufficient strength is a prime requisite. There should be no uncertainty as to whether the part is strong enough. Next, if the part is to be of any value, it must function properly. Finally, it is essential that all standard parts be as inexpensive to make as possible. These are the points which must be attended to if the standards are to be satisfactory.

What now are some parts which lend themselves best to standardization? Wheels, tires and control masts have already been mentioned. Seats offer many possibilities. Two seats being made in the same shop at McCook Field at the same time and for the same purpose weighed two pounds and nine pounds, respectively. Perhaps two or three standard seats of this type would meet all the requirements. Such a thing as the standard plywood rib used by McCook Field in practically all small rib design is another instance. The methods of securing the ribs to the spars which have been approved should certainly be standardized. Controls are well suited to standardization. There is no need for more than perhaps two sizes of rudder bars and maybe two styles. Control sticks of either wood or metal could readily be made up in standard form and kept in several different lengths. Two or three sizes of controls for a "dep" control would be ample. Several efforts, attended with considerable success, have been made toward standardizing cockpit dimensions, i.e., the relation of the seat to the air and engine controls. The general arrangement of instruments can also be standardized.

In addition to what might be termed absolute standardization of definite small units or parts there can be standardization in general design. For instance, why should a different type of chassis be designed for each aeroplane? A really satisfactory chassis is rare. Why not standardize, therefore, several types of chassis and merely change the angles, lengths and gages of the struts to fit the case? Why should not engine mounts be standardized the same way? There are very few good types. Such a matter as wing tip shape, if standardized would save much worry. Are not simple square tips rounded off with fairing better than the elaborately raked or rounded ones of the past?

With so many worries off his mind, a designer is left free to devote more time to real engineering and design work.

—B. C. B.



The News of the Week



Progress in Assembling the Airship "Roma"

The Airship "Roma," recently purchased by the United States from Italy, arrived at Langley Field in excellent condition in every respect, the envelope which contains the gas coming through in exceptionally fine shape. The envelope is at present inflated with gas, and the keel, which runs along the entire length of the ship, is completely assembled, as well as the greater part of the 6-power units.

It is expected that this ship will be ready for its trial flights in this country by November 1st, or shortly thereafter.

The "Roma" has a range of action of approximately 3,500 miles at 80 miles per hour. At cruising speed, a distance of 8 000 miles is estimated. Its capacity is 1,200,000 cubic feet, length 410 feet, width 82 feet, height 88.6 feet, and useful load in the neighborhood of 19 tons. It is driven by six 12-cylinder, 400 h.p. Ansaldo motors. It is contemplated substituting Liberty motors of corresponding horsepower for them at such time as they will require replacement. The ship is of a semi-rigid design, and practically no internal pressure is required to maintain its form under flight conditions.

Upon its entry in service numerous experimental projects in connection with the functioning of the Army Air Service will be carried out, including long-distance reconnaissance flights, photographic missions, coast patrol work, and the carrying of supplies for heavier-than-air units.

Under favorable conditions this ship is capable of making a non-stop flight from the Atlantic to the Pacific coast.

Elk Hunting by Aeroplane

As time goes on one cannot escape the growing conviction that the field of usefulness in which the aeroplane can be utilized is practically without limit. Mr. J. S. Hunter, of the Fish and Game Commission, hit upon the aeroplane as the means of fulfilling his desire to ascertain the number of elk in the vicinity of Buena Vista Lake, California, and with that end in view a special aeroplane flight was made from Visalia, California, on September 11th last.

A plane, piloted by Lieut. G. A. McHenry, Air Service, with Mr. Hunter as passenger, took off from the Visalia Field at 6:15 a. m., when a direct flight was made to Button Willow. At an altitude of 1,000 feet, flight was made along the edge of Elk Hills towards Buena Vista Lake. A return course was then taken a few miles north, and here a herd of ten elk were located and pictures of them were taken by Mr. Hunter. The entire country from the mountains on the south to the Kern River on the north was patrolled at various altitudes. This open country was covered in a manner that assured Mr. Hunter that there were no elk there. Going east towards Bakersfield, Mr. Hunter observed another herd in the trees along the Kern River, but owing to an attack of "air sickness," he did not call the attention of the pilot to this fact. He stated that owing to the heavy growth along the river it was not possible to estimate the number in this herd.

While this flight did not give an estimate of the number of elk in this section, it did show that the number here had been overestimated in the past.

Ten Planes Enter for Pulitzer Race

Omaha.—There are ten entrants for the second annual Pulitzer Trophy races for aeroplanes having a speed of more than 140 miles an hour, to be held November 3. Eighteen have entered for the John M. Larsen Trophy contest November 4, it was announced by Earl W. Porter, President of the Omaha Aero Club, when entries for both events closed October 25.

Both contests, and others, will be held in connection with a National Aero Convention called to form an organization to stimulate interest in aviation in the United States.

Aero Miles City Club

The Aero Miles City Club of Miles City, Montana, proved this year that commercial aviation can be and is successful in Montana and showed that there are many possibilities along this line which are bound to come in the future. With two Curtiss Standards and a Curtiss J-N 4, a good passenger and fair exhibition business was maintained throughout the summer and fall. The activities of the organization are state-wide. The Club gave the aerial exhibitions for the Montana State Fair in September, for the Miles City Roundup and several other smaller fairs.

The Club is a pioneer in the commercial aviation field in this state and the success attained is a tribute to Pilots E. T. Vance and A. W. Stephenson, as well as to others who have backed the project. W. G. Ferguson, secretary of the Club, is Disional Chairman for the World's Board of Aeronautical Commissioners for the State of Montana.

Aerial Mail Report

The report of performance of the Air Mail Service from July 1 to September 30, 1921, shows a percentage of 98. The best record for one complete quarter since the service was established. The performance of the entire service was as follows:

Percentage of performance, 98; number of miles flown with mail, 391,018; number of letters advanced, 10,014,280. The performance by Divisions: New York - Chicago, 98.5%; Chicago - Rock Springs, 97.6%; Rock Springs-San Francisco, 98%.

In addition to the 391,018 miles flown with mail on regular schedule, the records show 49,662 miles of test flights and ferry trips, making a grand total of 440,680 miles flown in the three months.

During the quarter we had eleven (11) crashes. In two accidents the ships were completely destroyed. In eleven cases of damage eight occurred on our fields and three at points of forced landings.

During the quarter there were no fatalities or injury to employes on regular mail trips. However, there was one fatality on a ferry trip. On July 16, 1921, Pilot Howard Smith lost his life in ship No. 222 on the San Francisco field. He was assigned to ferry this ship to Reno and fell from an altitude of 300 feet on the home field.

The cost per mile of operation during this period was: July, 73c; August, 71c; September, 70c. This shows an average of 71 1/3 cents per mile during this period. The records show that the cost during the same quarter of the year 1920 was 87 cents per mile.

An exceptionally good record is being made on that portion of the Transcontinental Route between Cleveland, Ohio, and Chicago, Illinois. The air distance is 335 miles. The last date on which a mail trip was defaulted was April 29, 1921. We have completed 24 weeks of 100% performance on this leg of the route and we are now on our 25th week without a break. During the 24 weeks, the mails were flown 96,480 miles without default.

A record flight was made by mail planes between Salt Lake City and San Francisco on Friday, October 14th. The time consumed from take-off at Salt Lake City (5:32) and arrival at San Francisco (11:33) was six hours and one minute. A stop for service of eleven minutes was made at Elko and a twenty-minute service stop was made at Reno; therefore, the actual flying time was five hours and thirty minutes.

Train No. 9. the fast exclusive mail and express train operated over the Southern Pacific Railroad has a schedule of 24 hours and 15 minutes between Salt Lake City and San Francisco.



The Sport Farman Taking Off at the Aero Club Meet at Curtiss Field. Some Climbing Angle

International Aero Congress

At the International Aero Congress, at Omaha, Nebraska, November 3-5, it was planned to discuss the following interesting topics:

Technical: 1. The applications of the results of wind tunnel tests of small models to the design of full size aircraft.

2. Commercial aeroplanes and seaplanes of monoplane or multiplane construction; thick and thin wings.

3. Dirigibles of large carrying capacity.

4. Aircraft motors for commercial use. Manner of mounting; method of transmitting power to the propellers.

5. Instruments for locating the position of aircraft and plotting their course.

Aerial Navigation: 6. Laying out and marking of aerial routes.

7. Installation and operation of airports.

8. Types of commercial machines; their adaptation to various kinds of transportation (passenger, postal, etc.). Record of safety of this means of transportation.

9. Insurance.

10. Aerial travel (Questions of law and customs; Discussion of Wadsworth Bill).

11. Physical and professional requirements for pilots; Source from which pilots are to be obtained.

The Aeroplane in Future Wars

"The aeroplane will be the most destructive force in the next war, which will be fought with all the horrible and terrible inventions that the mind of man can conceive," according to Mr. Hudson Maxim, the noted inventor, in an address he recently delivered before the Dayton, Ohio, Chamber of Commerce. Mr. Maxim declared that it will be possible to send the aeroplane anywhere, and there will be no force that will be able to combat it effectually; that when the next war comes the aviation forces will prove the greatest enemy of the navy, as Super-dreadnaughts and the latest inventions for naval warfare will not be able to fight this enemy in the sky. It will be necessary for the United States to have a merchant marine of the air which will equal that of any other nation and which can be easily converted into war machines. Without any such force, he contended, any country will be at the mercy of a nation which equips itself with such protection. The marine of the air is the only solution for the problem. Aeroplane production must be made so that ships will be perfectly safe, and decision to establish a merchant marine will mean the production of ships on a great scale both for industrial and military purposes.

Air Mail Service Praised

Postmaster General Hays recently congratulated the Air Mail Service in an open letter as follows:

We have been receiving some praise for the speed in handling the mails between New York and San Francisco, and I want to commend the work of the force in the Air Mail Service for their part in this quick handling of letters, also for the really wonderful record that you have made in the Air Mail Service during the last three months. Second Assistant Postmaster General Shaughnessy has furnished me with information as to how a letter, mailed in San Francisco after the departure of the passenger, was delivered in New York City before the passenger arrived by train.

The lady to whom the letter was addressed left San Francisco on the Overland Limited at 11 a. m. Monday and arrived in New York 10 a. m. Friday on the Twentieth Century. The daughter of the lady mailed the letter at San Francisco which left on an Air Mail plane at 2.30 p. m. Monday on regular schedule, flew to Reno, overtaking the Overland Limited. We dispatch all eastern mail to that train at Reno.

New York mail is carried on the Overland Limited to Cheyenne, arriving there at 5.25 Wednesday morning. The New York mail is taken off train No. 2 at Cheyenne, and an Air Mail plane leaves Cheyenne at 6 a. m. and arrives in Chicago at 6 p. m. the same day, connecting with New York Central train No. 32, which arrives at New York 4.45 Friday morning.

Without the aid of the Air Mail Service the letter in its regular course would have been delivered to the addressee in New York on Saturday afternoon.

Oakland Aero Club

The Oakland Aero Club of Oakland, Iowa, wish to announce that all pilots are welcome to land on their new airdrome, 3 miles southwest of Oakland, Iowa (on the Chicago-Omaha Air Mail Route). High test gas, oil and repairing available.

The field is marked by a large white cross in the best section of the field, which contains sixty acres, all level and good approaches. No obstruction, excepting a steel tower thirty feet high on the southern boundry of airdrome, on which is mounted the wind indication.

Mr. W. H. West, President; Lieut. Don Heyer, Vice-President: Mr. Oran Brown, Secretary, and Mr. Wilbur Nilan, Field Supt., of the Oakland Aero Club are responsible for the activities of the Club and the new field.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, September 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
															Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
																hrs. min.			
EASTERN New York-Chicago	$4,893.09	$926.55	$3,995.04	$2,934.55	$1,724.48	$774.34	$3,038.57	$1,570.60	$4,468.60	$5,409.27	$221.36	$1,674.00	$811.95	$32,442.40	13,399	463 39	41,508	$69.96	$0.78
CENTRAL Chicago-Rock Springs	5,232.58	1,524.19	*6,432.95	3,603.92	1,092.47	524.06	3,026.23	2,274.67	6,249.47	5,169.71	320.59	2,424.40	1,175.93	39,051.17	18,857	722 55	62,941	54.01	.62
WESTERN Rock Springs-San Francisco	3,405.15	782.04	†8,314.46	2,151.81	1,124.82	427.19	3,215.22	1,570.60	3,611.51	4,194.77	221.36	1,674.00	811.95	31,504.88	11,697	480 33	43,650	65.56	.72
Totals and Averages	$13,530.82	$3,232.78	$18,742.45	$8,690.28	$3,941.77	$1,725.59	$9,280.02	$5,415.87	$14,329.58	$14,773.75	$763.31	$5,772.40	$2,799.83	$102,998.45	43,953	1,667 07	148,099	$61.78	$0.70

* Includes rebuilding plane No. 210, and new wings on plane No. 177.
† Includes new wings and ailerons on plane No. 107, new wings and center section on plane No. 158.

Total Operating Cost	$102,998.45
Loss on Unrepairable Crashes	8,000.00
Permanent Improvements	6,221.84
Grand Total	$117,220.29

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern	$0.20	$0.25	$0.33
Central	.14	.20	.28
Western	.17	.18	.37
Entire Service	$0.17	$0.21	$0.32

Overhead consists of:
Departmental Overhead; Office Force and Watchmen; Motor Cycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio; Testing and Experimental Work.
Maintenance consists of:
Miscellaneous; Mechanics and Helpers; Repairs and Accessories, and Warehouse.
Flying consists of:
Gas; Grease and Oil, and Pilots.

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Key West-Havana Service to Resume

The Aeromarine Airways will continue this winter a service between Key West and Havana with five ten-passenger flying boats of the Santa Maria type. This particular route reduces the time of travel between Key West and Havana from seven hours (by boat) to seventy-five minutes; a saving of time and inconvenience which last winter was greatly appreciated by the traveling public, as indicated by the number of passengers carried without accident.

Plan Trans-Ocean Line

Buenos Ayres—Ninety hours from Cadiz to Buenos Ayres by airship is planned by Comandante Emilio Herrera, Spanish aviator and aviation expert. The plans are for a regular transatlantic passenger, mail and parcel service.

Herrera, who is returning to Spain after a visit here, said that a company is now being formed to finance this proposed first transatlantic air line. He hopes to be operating by 1923.

Operation of Forestry Patrol

A report from the Air Officer of the 9th Corps Area, summarizing the forest fire patrol activities for the entire season of 1921 up to September 1st, gives the number of fires discovered as 832; the number of patrols, 396; number of miles covered, 148,113; number of square miles observed, 7,230,459; flying time, 561 hours and 50 minutes; and the number of planes in commission, 47. The patrol bases were located at Camp Lewis, Wash.; Eugene, Oregon; Mather Field, Mills, Calif.; Corning, Calif.; and Visalia, Calif.

Due to the rainy season having begun, patrols in the States of Oregon and Washington were discontinued on September 10th, after having completed a very successful season, despite the shortage at times of gasoline and oil, necessitating the temporary suspension of operations.

A report from the Department of Agriculture states that the entire forest area in the United States covers 463,000,000 acres, and that this region is being burned over at the rate of 10,000,000 acres yearly, reforestation requiring a minimum of 20 years.

According to a statement which recently appeared in the newspapers, in 1920 the Air Service in 2½ months' operation of the forest fire patrol, saved from destruction by fire standing timber valued in excess of $35,000,000, or considerably more than the entire appropriation that year for the air defense of the United States.

This is a fitting testimonial to the great utility and value of the aeroplane in peace time pursuits—not to mention its functions in war—and a striking illustration of the important part the aeroplane is playing in conserving the natural resources of this country.

The excellent results obtained through the patrol by aeroplanes in locating forest fires has attracted wide attention and has led the Canadian Government and large timber corporations in the Dominion to establish the foundation for similar services.

Reduction in Naval Air Service

The curtailment of the activities of the Navy Air Service up to date has closed the stations at Cape May, N. J.; Yorktown, Va. (branch of the Hampton Roads Air Station), and Rockaway, N. Y. This leaves operating stations on the Atlantic Coast at Hampton Roads, Va.; Lakehurst, N. J.; Anacostia, D. C., and Pensacola, Fla., and on the Pacilc Coast at San Diego, Calif. Of these the Hampton Roads and the San Diego stations are the only sizeable ones now existing, as far as the Navy is concerned.

Due to the crash in England of the R-38, the airship station at Lakehurst is in a peculiar situation. What will be done with the station remains to be worked out following the financial settlement over the R-38, which will soon be taken up with the British government. If it is possible to obtain—as some of the high officers of the Bureau of Naval Aeronautics hope—one of the British dirigibles as part payment in the settlement, the activities at the Lakehurst station will be resumed. Otherwise they will cease for about a year, when it is expected that the airship ZR-1, now building at the station, will be completed.

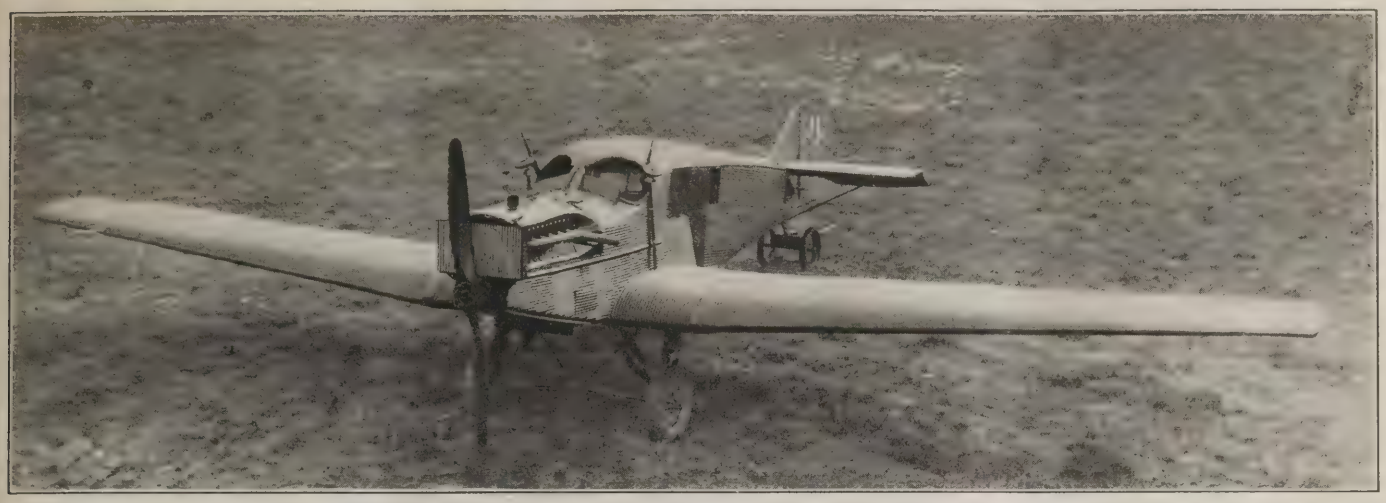
The Anacostia station, just outside of Washington, is maintained largely for experimental purposes. It is not regarded as an ideal naval air station in the accepted sense.

The station at Pensacola serves for training purposes, to supply fliers for the Atlantic and Pacific flees.

The reductions are due to the failure of Congress to provide sufficient funds for the maintenance of the additional stations. The appropriation for the current fiscal year amounts to $13,300,000, which includes funds for new aircraft.



An interesting group of aerial notables at the Ralph C. Diggins field. Left to right: Ethel Dare, plane change and wing walker, Al Wilson, Miss J. Bradley, Ruth Law, James Curren, chief instructor Diggins School, Mr. Lewis James, 19 year old aerialist, and Elmer Partridge, expert pilot



THE JL-12 ATTACK PLANE

THE JL-12 Attack Plane was designed and built by John M. Larsen, a well-known engineer and inventor, who in the course of his aerial touring has flown between 250,000 and 300,000 miles in this country and Europe. It is a type in advance of the latest foreign all-metal planes. The plane is 32 feet long with a wing spread of 49 feet and carries 130 gallons of gasoline. When manned by pilot and gunner and equipped with 3,000 rounds of ammunition and fuel for 500 miles of flight, it weighs 5,000 pounds. Its radius of action in battle is 400 miles from its supply base. The engine is a 400-horsepower Liberty motor.

The main battery of the plane consists of twenty-eight machine guns arranged in two sections. The first section is of twelve guns located directly behind the pilot's seat, and the second of sixteen guns, is mounted to the rear.

The firing is done by the manipulation of three levers, one firing half the battery, another the other half, the third being a master lever which puts all twenty-eight guns into action with a single motion. The two remaining guns of the thirty are fired at will by the pilot or gunner from the cockpit. The replacement of fresh magazines for all the guns requires only four minutes.

The plane itself is constructed of American-made duralium. The metal sheets are 25-1,000 of an inch thick, more than twice the thickness of that used in the latest foreign all-metal planes. It is braced throughout with steel, there being a powerful criss-crossing of rods in the wings, which are two feet thick at their greatest diameter.

In designing this plane, it was Mr. Larsen's idea to provide a flying machine which, through its high speed, its sensitiveness under control and its ability to climb rapidly, could be used successfully against infantry either on the field of battle or while "going up," or to the rear, or to attack a convoy on a roadway. The intent of the plane is to swoop down upon the enemy, fly low over him, perhaps at not more than fifty feet from the ground, and loose an annihilating fire from machine guns. After such a dash, the machine is to climb swiftly to give the gunner time to adjust new magazines to the guns and then to return to the attack.

By manipulation of the ailerons of the plane, the latter can be made to rock back and forth above the object attacked and thus spray the ground with bullets for a wide distance. The forward Thompson guns are set at a slight forward angle, six in the second battery point directly downward and the remainder are trained slightly aft, so that fire from the plane flies in three directions simultaneously.

The circular drums for the Thompson guns contain 100 cartridges and the ammunition equipment for the plane in battle trim consists of three drums for each of the thirty guns, a total of 9,000 cartridges.

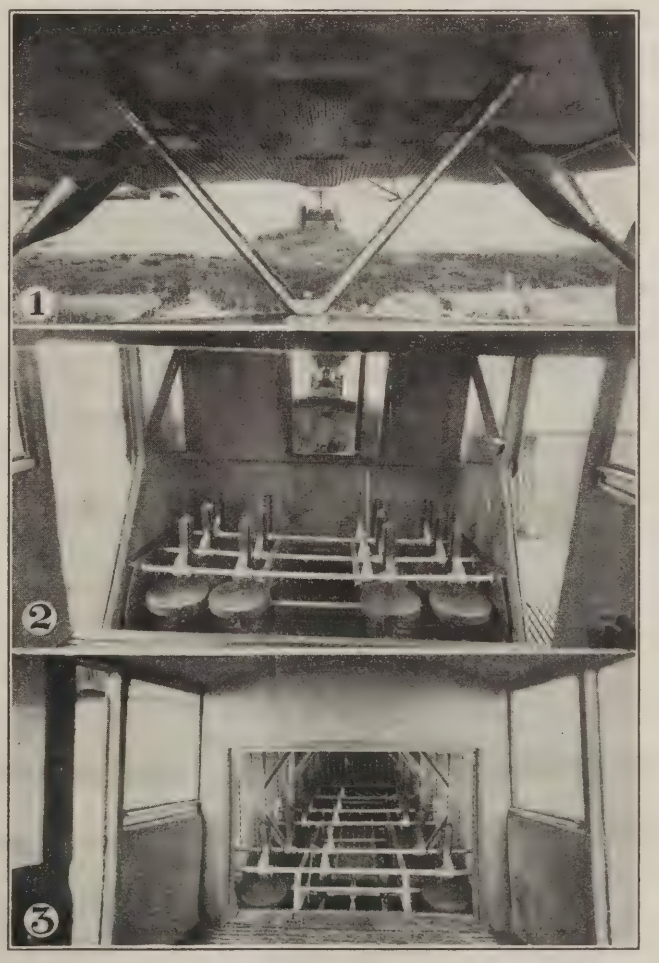
In discussing the machine Mr. Larsen stated: "It has been put through the most severe tests already and the flying and the battery performance have been perfect.

"One marked feature of the plane is its climbing ability. During a recent test it climbed the first 1,000 feet in 45 seconds and rose to 10,000 feet in less than 12 minutes. It is as fast as a scout plane and has high qualities of maneuvering at speed.

"Nothing has been overlooked to make it an irresistible weapon of war. Infantry, either in the open or intrenched, cannot possibly withstand its sheer velocity of flight and its appalling fire. It flies too fast to afford a target. It sets a pace which is strides ahead of anything like it in the world, and the best part of it all is that this plane is of American material and workmanship throughout."

Specifications

Type—All-metal monoplane.
Span—49 feet.
Length Overall—32 feet.
Height to Top of Cabin—400 horsepower.
Motor—Liberty 12—400 horsepower.
Control—Dual dep.
Weight of Plane empty (including cooling water)—2900 lbs.



1. View under surface of plane toward the rear. 2. Looking forward in the interior. 3. Looking to the rear of the fuselage interior

Weight of Plane with:
Armor, Armament of thirty (30) machine guns with loaded magazines, spare magazines and ammunition ..... 3848 lbs.
Fuel for 4 to 5 hours..... 800 lbs.
Pilot and Gunner 352
Total ..... 5000 lbs.

Maximum Speed—140-145 miles per hour.
Landing Speed—55-60 miles per hour.
Climb—1st 1,000 feet in 46 seconds; 10,000 feet in 11 minutes.
Armament—Thirty (30) machine guns, mechanically operated.
Armor—9/64-inch thick Armor plate.
Wheels—800 x 200 mm.

THE NEW ORENCO TYPE "F-4" TOURISTER AEROPLANE PROVES GREAT SUCCESS



The improved Orenco Type F Tourister aeroplane, the new "F-4", has proven itself equal to the difficult work of carrying 5 passengers in a comfortable manner at a very low operating cost. On its first flight on October 22d, Bert Acosta, accompanied by A. H. Phipps, the designer, took off in a short even run, climbed rapidly to 2,000 feet. After ten minutes spent in subjecting the machine to all the hard maneuvers likely to occur in ordinary flight, in order to severely test the controls, the machine was put into three successive loops, and the plane landed in a flat glide.

On the first trips, 50 gallons of gasoline and 6 gallons of oil were carried. Strict records were kept of the fuel consumed to determine the actual operating cost. These records show the time spent in the air as compared with the fuel consumption, and indicate that the actual cost is but 90 cents an hour per person, or less than one cent a mile per person.

Acosta, on the first flight, tried out the balance of the ship and found it to require no alterations. As the elevators are of the balanced type, they relieve the pilot of a great deal of the arm-strain. The F-4 is equipped with the new Model E-2 Wright engine developing 190 H. P. The speed was measured over a carefully marked course. The cruising speed is 95 miles an hour and the high speed, 110 miles an hour, a remarkable performance with such a load and such low horse-power. A specially designed and highly efficient Hartzell propeller is one of the features to which the speed is attributed.

On the following day E. F. White flew the machine carrying Mr. E. R. Michie, Vice-President of the Ordnance Engineering Corporation, his son, Jack and daughter, Katherine as passengers. Several other passengers were carried on October 23d, including Miss White, Miss Sarah Cook, R. C. Greenwood, Wm. F. Schult, John M. Beck, Jr., and George Page. An altitude flight to 15,000 feet was made by Art Heinrich, with 3 representatives of the press and the Aero Club of America. Motion pictures were made over New York City. Demonstration flights are being made on week-ends and during the week by appointment. As fuel can be carried for five hours, cross-country flights of 500 miles or more may be made with ease. Dual controls provided in the rear cockpit allow two pilots to alternate handling the ship and permit instruction in the easiest manner possible.



The Orenco Type F-4 Tourister

THE RESISTANCE OF AEROFOILS

By W. F. GERHARDT

Aeronautical Engineer, McCook Field

(A review of some of the most important ideas developed by Dr. Geo. de Bothezat in his Aerofoil Memoir.*)

(*Continued from page* 178)

The foregoing discussions of the laws of air resistance of aerofoils interprets the empirical results which are of most immediate use in aviation. A deeper knowledge of the relations which govern the phenomena requires an analysis of the airflow around the aerofoil.

The Flow Around an Aerofoil

WHEN an aerofoil moves through the air with a uniform rectilinear velocity of translation, the following flow phenomena are observed.

As previously mentioned there occurs the well known pressure distribution and the deflection of the air stream in the sense opposite to that of the lift. In addition there can be observed a periodicity to the flow in the wake of the aerofoil due to the system of vortices there formed, called the edge vortices, the axes of which are perpendicular to the stream velocity; and two vortices coming off the tips called the tip vortices with axes parallel to the direction of motion.

In order to picture the general nature of the fluid flow and to evaluate the relations which govern the action of these component phenomena, Dr. de Bothezat develops an ideal scheme of the flow. This scheme is only a conceptual limit, which the actual merely approaches, but it takes account of the fundamental variables, and permits of the calculation of the relations between them.

Scheme of Fluid Flow

Consider a cylindrical body (Fig. 21) of infinite length and having a plane of symmetry parallel to the direction of its velocity V_o. Let us imagine an observer moving with the body. For such an observer a relative stream of air will run on the body. This effective or relative stream can be replaced by a conventional relative stream so defined that it will be fully equivalent to the actual stream so far as the resistance encountered by the body is concerned.

Let us first assume that in each cross-section of the stream, normal to the plane of symmetry, the velocity of the air-stream is constant. In order to take care of the fact that the stream has a greater velocity than that of the surrounding air, due to the presence of the body, we must consider that this relative stream is limited in section and bounded on the outside surfaces of discontinuity S S, and at the body, by the surfaces of discontinuity S^1 S^1. We thus see that in this scheme, the flow is inmodified outside S S; between S S and S^1 S^1 the velocity is in excess of V_o; inside S^1 S^1 the velocity is zero.

In this conception of the flow phenomenon, the vortices are considered to be concentrated on the body and the outside boundary, that is, the surfaces of discontinuity are vortex sheets. This is a condition which seldom occurs, as the vortices are finite and spread throughout the fluid. The actual case may be considered as a breakdown of this ideal case.

Consider two sections of the relative stream I and II, immobile relative to the body and normal to the stream. Section I of conventional height h_o, is taken in front of the aerofoil at such a position not reached by the disturbance created by the body. The relative velocity and pressure in this section are V_o and p_o. Section II is taken behind the body where the velocity and pressure are V and p.

If C is the Bernouilla constant corresponding to Section I,

$$p_o + \frac{\delta V_o^2}{2} = C \tag{17}$$

If we follow a stream line in the relative motion of the fluid with respect to the body we find that, starting with the pressure p_o and velocity V_o, the pressure decreases and the velocity increases as we pass the body; further on the pressure increases and the velocity decreases until at Section II we have the velocity and pressure V and p.

In the movement from I to II, losses occur inside the fluid by viscosity and at the surface of the body by "skin friction,"—that is, some energy $\triangle C$ is dissipated in heat. Hence in Section II,

$$p + \frac{\delta V^2}{2} = C - \triangle C \tag{18}$$

$$\triangle C = p_o - p + \frac{\delta}{2}(V_o^2 - V^2) \tag{19}$$

But $\triangle C$ is nothing more or less than the interior work of a volume of the relative flow crossing the two sections. This unit volume is

$$h_o V_o = hV \tag{20}$$

and if π is the total work

$$\triangle C = \frac{\pi}{h_o V_o} \tag{21}$$

But this work can always be considered as the product of a ficticious force F and the velocity V_o.

$$\pi = FV_o \tag{22}$$

Hence

$$\triangle C = \frac{FV_o}{h_o V_o} = \frac{F}{h_o} \tag{21}^1$$

or

$$F = h_o(p_o - p) + \frac{\delta h_o}{2}(V_o^2 - V^2) \tag{23}$$

The above is the general picture of the flow about the body.

Let R_x be the drag per unit of length of the body. Let us apply the momentum theorem to the fluid between the boundaries and the body, included between the planes I and II (considered to be a unit distance apart). This theorem states that in a system of bodies, the algebraic sum of the exterior forces must be equal to the change of momentum of the system per unit of time. In this case the exterior forces are the drag on the body and the resultant pressure. This latter force is $h(p_o - p)$ and is applied normally to Section II.

$$R_x - h(p_o - p) = (\delta h_o V_o)V_o - (\delta hV)V \tag{24}$$

or

$$R_x = h(p_o - p) + \delta(h_o V_o^2 - hV^2) \tag{25}$$

It is at once evident that the drag is about equal to the dissipative force F.

Suppose, for example, we choose section II at such a position in the stream where $V = V_o$. It follows from (20) that $h = h_o$. Hence from (25)

$$R_x = h_o(p_o - p) \tag{25}^1$$

and

$$F = h_o(p_o - p) \tag{23}^1$$

hence

$$R_x = F$$

Or let Section II be taken where $p = p_o$. Then

$$R_x = \delta(h_o V_o^2 - hV^2) \tag{25}^{II}$$

$$F = \frac{h_o \delta}{2}(V_o^2 - V^2) \tag{23}^{II}$$

$$= \frac{\delta h_o V_o^2}{2} - \frac{\delta h_o V^2}{2} + \frac{\delta h_o V_o^2}{2} - \frac{\delta h_c V^2}{2}$$

$$= \delta h_o V_o^2 - \frac{\delta}{2}(hV^2 + h_o V_o^2)$$

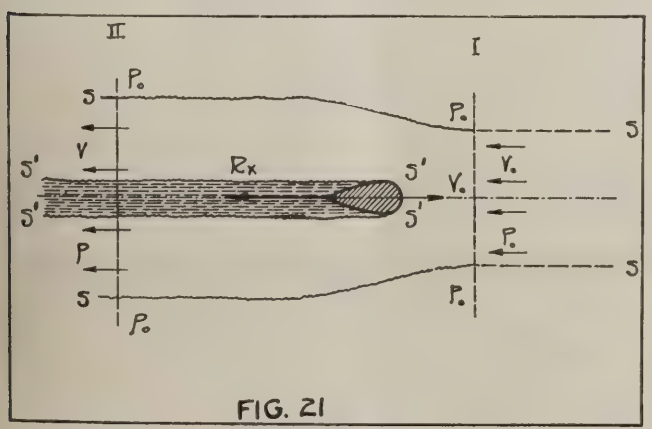


FIG. 21

* "Introduction to the Study of the Laws of Air Resistance of Aerofoils," by Dr. G. de Bothezat, N. A. C. A., 1918.

$$= \delta\, h_o V_o^2 - \frac{\delta\, hV^2}{2}\left(\frac{h_o}{h} + \frac{h_o V_o^2}{hV^2}\right)$$

$$F = \delta\, h_o V_o^2 - \frac{\delta\, hV^2}{2}\left(\frac{V}{V_o} + \frac{V_o}{V}\right)$$

and since $\frac{V}{V_o}$ is very close to unity, $\frac{V}{V_o} + \frac{V_o}{V} \simeq 2$

Hence $F = \delta\, h_o V_o^2 - \delta\, hV^2$

$R_x = F$

Let

(26) $F = f\, \delta\, b\, V^2$

where f is a characteristic coefficient depending on the form of the body the properties of the fluid, and the position of Section II. Also we have

$(5)^I$ $R_x = k_x\, \delta\, bV^2$

Then when $V = V_o$ or $p = p_o$

$$f \simeq k_x$$

It is evident that, since the energy in the fluid is dissipated in two ways,—by surface or skin friction (vortex sheets) and vortices (quincunx system), the former which can never be eliminated is the inferior limit of f.

The Infinite Aerofoil

Let us now apply this scheme of the fluid phenomenon to the aerofoil. All that has been said with regard to the body of pure drag applies to the aerofoil case, with the additional requirement that in the latter case there must exist a component of the fluid momentum normal to the stream in order that there be lift. The fluid stream must be directed downward.

This generalized scheme is shown in Fig. 22. The relative stream runs on the aerofoil with velocity V_o. It is bounded by the vortex sheets S S and S^1 S^1. Leaving the aerofoil it is first directed downward, but afterward comes back to its original horizontal position. Sections I and II are chosen by the above mentioned criteria.

As before, the dissipative force is

$$F = h_o\,(p_o - p) + \frac{\delta\, h_o}{2}\,(V_c^2 - V^2)$$

The resultant pressure on the liquid mass is still $h\,(p_o - p)$ normal to Section 11. (Summing up all the pressures).

Applying the momentum theorem to the case we have,

(27) $R_x - h\,(p_o - p)\cos\alpha = \delta\, h_o V_o^2 - \delta\, hV^2 \cos\alpha$

(28) $R_y + h\,(p_o - p)\sin\alpha = h\,\delta\, V^2 \sin\alpha$

Now in the case Section II is chosen where $V = V_o$, then $h = h_o$ and

$(27)^I$ $R_x = h\,(p_o - p)\cos\alpha + \delta\, h\, V^2\,(1 - \cos\alpha)$

$(28)^I$ $R_y = -\,h\,(p_o - p)\sin\alpha + \delta\, h\, V^2 \cos\alpha$

also

$(23)^I$ $F = h_o\,(p_o - p) = h\,(p_o - p)$

(26) $F = f\,\delta\, b\, V^2$

then

$(23)^I$ $F = h\,(p_o - p) = f\,\delta\, b\, V^2$

But

$R_y = k_y\,\delta\, b\, V^2$

$R_y = k_x\,\delta\, b\, V^2$

Substituting in $(27)^I$ and $(28)^I$ and simplifying

$(29)^1$ $k_x = \frac{h}{b} - \frac{h}{b}\cos\alpha + f\cos\alpha$

$(30)^I$ $k_y = \frac{h}{b} - f\sin\alpha$

Hence

$(31)^I$ $$\sin\alpha = \frac{k_y}{\frac{h}{b} - f}$$

$(32)^I$ $$\cos\alpha = \frac{\frac{h}{b} - k_x}{\frac{h}{b} - f}$$

or since

$$\sin^2\alpha + \cos^2\alpha = 1$$

$$k_y^2 + \left(\frac{h}{b} - k_x\right)^2 = \left(\frac{h}{b} - f\right)^2$$

then

$(33)^I$ $$h = \frac{b\,(k_y^2 + k_x^2 - f^2)}{2\,(k_x - f)}$$

Neglecting the squares of k_x and f:

(33) $$h = \frac{b\,k_y^2}{2\,(k_x - f)}$$

Introducing this value of h in $(31)^I$

$(31)^I$ $$\sin\alpha = \frac{2\,k_y\,(k_x - f)}{k_y^2 + 2\,f\,(k_x - f}$$

Neglecting $2\,f\,(k_x - f)$

(31) $$\alpha = \frac{2\,(k_x - f)}{k_y}$$

In the second case, when Section II is taken where $p = p_o$ we have from the momentum equations.

$(27)^{II}$ $R_x = \delta\, h_o V_o^2 - \delta\, h\, V^2 \cos\alpha$

$(28)^{II}$

Simplifying, using relations $(23)^{II}$, $(2)^I$ and $(3)^I$

$(29)^{II}$ $$k_x = \frac{h_o}{b} - \frac{h_o}{b}\frac{V^2}{V_o^2}\cos\alpha$$

$(30)^{II}$ $$k_y = \frac{h_o}{b}\frac{V^2}{V_o^2}\sin\alpha$$

and

$(31)^{II}$ $$\sin\alpha = \frac{k_y}{\frac{h_o}{b}\frac{V^2}{V_o^2}}.$$

$(32)^{II}$ $$\cos\alpha = \frac{h_x - f}{\frac{h_o}{b}\frac{V^2}{V_o^2}}$$

But from the expression for the dissipative force F:

$(23)^{II}$ $$F = \frac{\delta_o\, h_o}{2}\,(V_o^2 - V^2) = f\,\delta\, b\, V_o^2$$

we see that

$$\frac{V^2}{V_o^2} = 1 - \frac{2\,f\,b}{h_o}$$

and since $\sin^2\alpha + \cos^2\alpha = 1$, then

$$k_y^2 + \left(k_x - \frac{h_o}{b}\right)^2 = \left(\frac{h_o}{b}\right)^2 \left(1 - 2\frac{fb}{h_o}\right)^2$$

$(33)^{II}$ $$h_o = \frac{b\,(k_x^2 + k_y^2)}{2\,(k_x - f)}$$

Neglecting the squares of k_x and f

$(33)^{II}$ $$h_o = \frac{bk_y^2}{2\,(k_x - f)}$$

Substituting this value of h_o in $(31)^{II}$

$$\sin\alpha = \frac{2\,k_y\,(k_x - f)}{k_y^2 - 4f\,(k_x - f)}$$

or, neglecting small terms as before

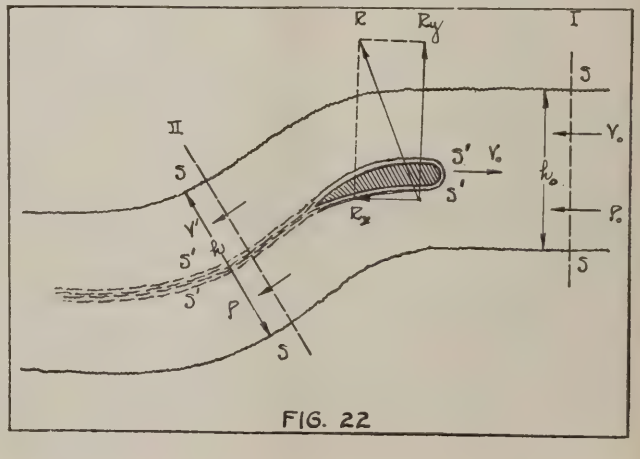


FIG. 22

$$(31)^{11} \qquad \alpha = \frac{2\,(k_x - f)}{k_y}$$

Let us now rewrite (31) and (33).

$$(34) \qquad k_x = f + \frac{\alpha\, k_y}{2}$$

$$(35) \qquad k_x = f + \frac{b\, k_y^2}{2\, h_o}$$

hence

$$(36) \qquad k_x = f + k_x^1$$

$$(37) \qquad k_x^1 = \frac{\alpha\, k_y}{2} = \frac{b}{2\, h_o} k_y^2$$

Whence

$$(38) \qquad \alpha = \frac{b}{h_o} k_y$$

We thus see that the total drag of an infinite aerofoil is the sum of two drags, the dissipative force f and the component of the momentum k_x^1 to the direction of motion. When f = o, i. e. in a frictionless fluid.

$$k_x = k_x^1$$

Considering relation (38) we observe that (1) if h_o is infinite, that is, the amount of liquid displaced is very large, then the angle α is infinitesimal and

$$k_x^1 = o$$

$$(39) \qquad k_x = f$$

(2) When h_o is finite and constant, that is, the amount of liquid is limited either artificially or by the nature of the flow, then

$$\alpha = C_1\, k_y$$

$$k_x^1 = C_2\, k_y^2$$

$$(40) \qquad k_x = f + C_2\, k_y^2$$

that is the drag is a parabolic function of the lift.

Actually, as has been observed, the wind tunnel tests show that the phenomenon takes place *nearly* as if the former assumption held true, and

$$k_x = f$$

Now f varies little with angle of attack since it is composed of friction forces. Hence, the *drag* of the *aerofoil of infinite aspect* ratio which is called the *profile drag* of a finite aerofoil is *nearly independent of the lift.*

It is the vortex system that produces the marked parabolic drag tendency.

(To be continued)

HELIUM FOR AIRSHIPS

In the course of an interview with a correspondent of a British newspaper shortly following the recent ZR2 Airship disaster, Major P. E. Van Nostrand, of the Balloon and Airship Division, Office of the Chief of Air Service, who was to have returned to America aboard the big dirigible, asserted that airships can be made safe, and that while Helium is the best gas known for airships—and he hoped the time will come when not only naval and military airships but commercial airships as well will be filled with Helium—petrol rather than hydrogen is the greater menace to the safety of airships. He is of the opinion that hydrogen can be used, and used safely, pointing to the fact that the hydrogen gas in the latter part of the ZR2 apparently did not explode, but came down intact, demonstrating that buoyant gas, if it stays in the bag, is a help rather than a danger. He added that if the ZR2 had been filled with Helium, the result of the accident would have been little more than a casual wetting for the men aboard her—provided a less explosive fuel than petrol had been in use.

At the present time, in view of the fact that the supply of Helium is very limited and difficult to obtain, the problem is to find a less volatile liquid for burning than petrol, and this, in Major Van Nostrand's opinion, is an easier proposition than to obtain Helium.

While touching on the subject of Helium, it might be well here to give a brief history of this new gas for use in airships, its present rate of production and the experimental work now being conducted therewith.

Helium is a gaseous chemical element discovered by Sir William Ramsay who, after numerous experiments, found that it refused to oxidize when sparked with oxygen. It is the lightest of absolutely inert gases, and occurs in the air in proportion of 0.000056 per cent by weight, or about one volume of Helium in 250,000 volumes of air. It also occurs in many minerals, including monazite sands, in the gases of many mineral springs, and in comparatively large quantities in several of the natural gases of Canada and the United States.

Commercially pure Helium has 92.6% lift of pure Hydrogen, and being absolutely inert has no deteriorating effect upon balloon fabrics, and is safe from combustion under all conditions. It is the all-round ideal balloon gas so long sought by scientists.

Up to April, 1918, Helium had been obtained only in extremely small quantities, and for scientific purposes only—the total amount probably not exceeding 100 cubic feet, at a cost of about $1,700 to $2,000 per cubic foot. The most promising fields thus far discovered are located in Texas, Kansas, and Ohio. It is believed by scientists that other sources of supply will be discovered, susceptible of development for the production of Helium in balloon quantities, as the result of exploration work. At the present time such an exploration program is being actively prosecuted by the Government.

After our entry into the war three experimental plants for the production of Helium from natural gas obtained from the Petrolia pool at Petrolia, Texas, were erected. Two of these, known as Plants No. 1 and No. 2, were located at Fort Worth, Texas, the gas being supplied through a pipe line from the former place, and the last plant, known as Plant No. 3, was established at Petrolia.

The cost of producing one cubic foot of Helium in a mixture of 92% purity in Plant No. 1, the most successful plant to date, was about 39c, showing the extremely remarkable reduction in the price of producing Helium, especially when the fact that this was an experimental plant and not of such proportions as to give lowest cost, is taken into consideration.

After Helium of 92% purity was produced in Experimental Plant No. 1, the Navy, acting for the Army and Navy, entered into a contract with the Linde Company for the erection of a large production plant at Fort Worth. Latest figures on the cost of producing Helium in the new production plant, as estimated by the Navy Department, which is in charge of its operation, show that 94.5% Helium costs $150.01 per 1,000 cubic feet, and 99% Helium as $280.12 per 1,000 cubic feet.

Helium provides the United States with a weapon of warfare which is apparently not available to any other nation, because nearly all of the practical supplies of Helium so far discovered are contained within the borders of this country. On account of the anticipated further reduction in the cost of this product below the present figure, it would seem advisable that the Government should not relax its endeavors to further the exploration and development of this gas, for with an adequate supply of Helium the future of the airship in this country would be assured.

The average production of Helium in this country at the present time is such that, when compared with the production figures in the past, it would indicate that Helium production is making encouraging progress.

One of the most important problems that will have to be solved in connection with the use of Helium in lighter-than-air craft is the question of its loss by expansion and consequent valving. Due to the excessive cost of this gas, a more radical departure will have to be made in the method of handling the gas pressure than obtains at present with automatic valves in Type R balloons and airships. The Navy is preparing to conduct aerial experiments with Helium in an airship of the C Type, and the U. S. Army Air Service will do likewise upon the completion of the airship that is being designed particularly for the use of Helium.

With regard to the repurification of Helium, the Army Air Service has two plants under construction for conducting this work—one the Railroad Repurification Plant in Washington, and the other a stationary Repurification Plant at Langley Field, Hampton, Va., both of which are under the jurisdiction of the Bureau of Mines.

The Railroad Repurification Plant at Washington is now approaching completion, and consists of two cars, one utilized for producing power for the operation of the apparatus contained on the other car. This apparatus, through the process of refrigeration, absorbs the impurities (consisting principally of air) contained in the Helium. The capacity of this plant is approximately 2,000 cubic feet per hour. Being built on standard railroad cars, the plant is capable of being transported to any section of the country upon short notice. It is intended to utilize it for the repurification of Helium in use at isolated stations where it is inadvisable to locate permanent repurification plants, the impure Helium at these stations being allowed to collect for a period of six months or so, stored in cylinders, and is then repurified upon the annual or semi-annual visit of the Railroad Repurification Plant.

The plant at Langley Field, Va., which was designed and developed for the Army Air Service by Dr. Harvey M. Davis, Mechanical Engineer, Harvard University, has a capacity in excess of 2,000 cubic feet per hour, and the method used is the

(Concluded on page 207)

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

South Dakota

CRAWFORD to MINECARTA, choppy to rough, safe alt. 3000′ MINECARTA to HOT SPRINGS, very rough, trees, rocky, etc. Bad Lands, air bumpy. ALLIANCE, Nebr., to SCOTTS BLUFF mostly level, cap rock at Bluff. This place and GERING, Nebr., all under irrigation.

Territory of South Dakota east of the Missouri River is about the same as North Dakota. It is especially adapted and offers any number of suitable landing fields in case of forced landings.

South Dakota may be well described as North Dakota has been covered, as the fields are large, often being one mile square, and the fences are few, with practically no trees in some parts of the state. It is one vast prairie.

Western half of South Dakota—open and rolling, but plenty of good landing fields. Mostly grazing land.

Entire eastern part, to 150 miles west of Minnesota line is all excellent. The best all-round flying land in the country. No obstructions except a lake here and there.

At SHERMAN, S. D., there is a wonderful landing field at the very north edge of town, and one right across the road south.

Central western South Dakota is all quite good, lots of good fields.

Tennessee

MEMPHIS to TUPELO, see MISS.

That portion of Tennessee on a line from MEMPHIS to CLARKSVILLE is rolling and in lots of cases, very hilly. The same thing applies to that portion of Kentucky, CLARKSVILLE, Tenn., to LOUISVILLE, Ky.

Western Tennessee is fair, but farther inland it is quite difficult to find any place to land.

Western Tennessee—a rolling wooded country. Stretches of woods along rivers, 15 miles or so across. Much cotton, and hidden stumps. The fields are small and the ground washes easily so there are many gullies. A few good fields for slow landing planes, but none for fast ships. Some years some of the cotton fields are planted to grass and this makes more fields.

As a rule a forced landing here is a crash. Suggest landing within cotton rows, even with moderate cross wind. The sand bars along the Mississippi are many of them safe for landing.

Good fields—Driving Park, Memphis. Park Field—30 miles No. of Memphis.

Generally, no place for a ship.

Texas

Risk of being unable to find a good landing field in Texas is very slight. Whole state is really one big landing field. In the southwest corner around ALPINE and EL PASO it is mountainous, but if one avoids mountains and keeps to the valleys, cross-country flying is comparatively safe.

MARSHALL to FORT WORTH. Timber and hilly at start and first thirty miles, then more level, more timber patches and open patches, then less timber, more farms, cotton patches, etc. Air gets poorer, especially in summer. Near FORT WORTH several good landing places, safe alt., as follows, 4000′ start, 3000′ centre, 2000′ end.

MARSHALL Air Line to HOUSTON, one very bad strip shortly after start about 15 miles all timber, rough, no landings, then gets line on to FORT WORTH, only more level nearing HOUSTON and air better. Houston, Normana, Beeville, Kingsville, all good flying, mostly level, few timber strips, air good, watch irrigation ditches, also winds from coast, Corpus Christi section.

FORT WORTH to DALLAS, large hilly section, safe altitude 4000, not much timber, farms, etc. DALLAS, pretty good, some good landing places, small tree patches, some hilly country, some farm patches, air good in winter, bad on low power, extra hot weather.

DALLAS to WACO, about same as DALLAS-FORT WORTH, safe alt. 3500. WACO to CRAWFORD, mostly farms, open on sort of tableland. WACO air not good in summer. WACO to AUSTIN, first half, as above, gets rougher near AUSTIN, to very rough altitude first 3500′, centre 4500′ and last 5000′. Only one safe place to land AUSTIN. Hilly rocks, some timber. AUSTIN to SAN ANTONIO, via TYLER. As above start, leveler after twenty miles, more timber level and small hills, with considerable timber TYLER. Alt. 3500′, this changes into MESQUITE upon approaching SAN ANTONIO, with creeks that are rough, rest level. South of SAN ANTONIO, rocky mills. East, lake, Mesquite, west Mesquite to timber, and rough.

FORT WORTH to TEXLINE. FORT WORTH to HENRIETTA, hilly to level, farms, less trees, air lighter. HENRIETTA to WICHITA FALLS, more level, about same. Safe alt. 2000′.

WICHITA FALLS to BERNON, about same, alt. 2000′. VERNON to CHILDRESS, gets rougher, red clay hills, safe alt. 2500′. CHILDRESS to MEMPHIS, gets rougher, more chop hills, air lighter, fewer landing places. MEMPHIS, Tex., to CLARENDON, cross RED RIVER breaks, bumpy red clay hills first, then more rolling oil bumps. Safe alt. 3000′. CLARENDON to CLAUDE, becomes level prairie. (Note—all along the ed River are breaks and rough), also from there way east to Memphis, over into ANTLERS, OKLA., country is rough, hilly, coal mines, this is on north bank. CLAUDE, Tex., to AMARILLO, same, level, air light. AMARILLO to TASCOSA, becomes rougher, breaks of the CANADIAN RIVER, safe alt. 3000′.

TASCOSA to CHANNING, rough to rolling, some sand hills. CHANNING to DALHART, rolling to nearly level, some plateau land with bumpy "crevices." DALHART to TEXLINE, high level prairies. Air light, unsafe, puffy hot day DALHART to TEXHOMA, via Stratford—same as above, only more level, slightly better air. TEXHOMA (Okla-Tex.) to AMARILLO, via DUMAS, Tex. Rolling long prairies, DUMAS level, south enter patches of sand hill, then bad breaks of CANADIAN RIVER, then rough rolling to level upon arrival AMARILLO. Air only fair, bumpy over Canadian breaks most all time.

AMARILLO to TEXOLA, via Pampa, Canadian, Miami. To Pampa rolling to level, to Canadian gets rougher, more hills and timber, cap rock. To Miami very rough. Cap rock to TEXOLA via SHAMROCK, becomes more level. SHAMROCK is hilly, TEXOLA slightly. Not much timber, air slightly better, windstorms. AMARILLO to TEXICO, via HEREFORD, much timber. FARWELL, mostly level to rolling, one small canyon to cross and cap rock. Safe alt. 1000 feet. AMARILLO to LUBBUCK via Canyon, level, rough Canyon, rolling to level, some trees, air fair. LUBBUCK to PLAINVIEW, mostly level. PLAINVIEW to FLOYDADA, same, farms. FLOYDADA to SILVERTON, some rolling, mostly level. SILVERTON to TULIA, same, some hilly TULIA. TULIA to PLAINVIEW, via Happy Level. TULIA to AMARILLO, mostly level. AMARILLO to TUCUMCARI, N. M. To Veja level, then rolling, then breaks; then upon approach to Tucumcari, rough. Thence to SANTA FE, gets very rough. Spur, fairly level, Matador, hills to level. Stamford, same. New Braunfals, timber, poor flying. Farwell, level. El Paso, rough, Fort Bliss, rolling. Rule, half level, part rolling.

From TULSA, Okla., to FORT WORTH, Tex., is all good territory. Almost the entire northeast section of Texas is good. On a line from FORT WORTH to SHREVEPORT, La., the country gets bad from Mineola, Texas, east.

Texas is very good. Government fields are very numerous here.

Texas as a whole, excepting East Texas, is very good country for cross-country flying. A pilot can nearly always find a place for a forced landing. Air lines between HOUSTON and DALLAS, and HOUSTON and SAN ANTONIO are good. Between HOUSTON and SHREVEPORT, La., a pilot will find much wooded country and places for forced landings few and far between.

The air in western Texas is none too good for a novice to work in.

DALLAS is due south from OKMULGEE, Okla., and it is a regular air route, lots of good fields. LOVE FIELD in Texas is an army field.

Texas is the best state in the Union for cross-country work. Seven complete Government aviation fields, two of them being double-unit fields, were located in Texas because of the admirable climatic conditions and because of the flat country extending over most of the state. From the Gulf to the North State line, and from the East boundary to a North and South line intersecting SAN ANTONIO, with the exception of a few hundred square miles in the central part of East Texas, all of this territory covered has abounded with good fields and much open country.

Practically all of the excepted portion mentioned is thinly settled, seldom flown over and has no town of sufficient size to warrant an aviator in there locating. So it is almost a surety that no application for coverage will be received from that section of the state. Any other portion of the state, within the boundaries mentioned, is a safe risk.

Along the Gulf Coast of Texas, ranging from ORANGE to GALVESTON, and extending inland for about twenty miles, is a marshy, swampy stretch of land, but a landing in it would only entail difficulty in removing the plane, or possibly a broken propeller. It is treeless, but has high grass. However, all of the travel along the coast line given is done along the edge of the Gulf, which gives a constant landing field in the form of a good, wide sand beach.

From ARKANSAS CITY to WOODWARD, Okla., all country south of this to WACO, Texas, is open and wonderful country to fly over and very flat, with the exception of a little string of mountains that run west from FT. STILL. These mountains are low and about two miles across in the widest place. From WACO, TEXAS, to HOUSTON, following the Brazos River is very good, but a lot of timber is on either side of the river, especially on the east.

Texas is good between GALVESTON and MEXICO—level. North of Houston 30 miles a stretch of woods to the N.E. that appears to be solid, to ALEXANDER, La., and for a long ways north of HOUSTON. It is open southwest and northwest of Houston. To the east one has only a few 10-mile stretches of timber between HOUSTON and BEAUMONT. It appears to be solid timber, north of BEAUMONT. All along the Gulf from south of CROWLEY to GULFPORT, Tex., there is a good sandy beach, no timber, but with some floating bog near ORANGE, Texas.

Country between VICTORIA and HOUSTON, fair. AUSTIN, a little hilly. BATON ROUGE CO. mostly river and sugar cane. All rice fields have ditches and most of the year or except in fall, are very soft. There is much timber in this section. An open space extends from ALEXANDER as the tip of the triangle with KINDER and LAFAYETTE, as the base, mostly rice. From CROWLEY south and west it is all open but *mostly* rice. This rice belt extends to BEAUMONT, TEXAS. One can avoid the timber by following R.R. tracks and although it is mostly woods between New Orleans and Lafayette, a slow ship could find a few places to land. There is no field near New Orleans.

Vermont

There are many recognized landing stations in Vermont, which makes that state good. Routes running into this state are comparatively safe going. One of these routes is to follow the Conn. River to BURLINGTON. Most of the country any distance away from established air routes here is hazardous, very risky to fly over.

From RUTLAND to KEENE, N. H., passing through GREENFIELD, Mass., is a good route to follow, if a reasonable altitude is kept.

Virginia

Western part of state very mountainous; rough country starts 15 to 20 miles east of LYNCHBURG: central part of state fairly open, though there are large sections of timber land there. Eastern part of state near NORFOLK, much timber. Between NORFOLK and LYNCHBURG first 25 to 30 miles, very few open fields.

From DANVILLE to ROANOKE, mountainous, no chance for landing except in vicinity of rivers. ROANOKE to LYNCHBURG, mountains land near rivers. LYNCHBURG to DURHAM, N. C., very hilly country but landings can be made with luck.

On the route from WASHINGTON through LYNCHBURG, Va., and on south, conditions are very good for a flyer to travel around 2,000′ elevation. On route from NORFOLK through LYNCHBURG, the conditions are ideal until one reaches this city flying at a thousand or fifteen hundred feet. Going west from LYNCHBURG, an altitude of three to five thousand feet is advisable as one progresses west. There is a field outside of Lynchburg that has a peculiar cross current at the lower end, caused on account of a ravine and a clump of trees, on other side; two pilots broke their undercarriage propeller and one wing not thirty feet from one another.

Striking south and west from Langley Field, Va., across Chesapeake Bay, following the Atlantic Coast Line R.R. through NORFOLK and on through Suffolk into North Carolina to RALEIGH, the terrain here is very poor; no landing fields at all for about fifty miles. Then one begins to see small plowed fields and pine trees, with only an occasional green field, few of which could be landed in with any degree of safety.

Along the route Greensboro to Langley Field through Virginia, conditions are a little better. Along the Southern R.R. to DANVILLE, Va., thence the eastern branch of the Southern through Clarksville, Lawrenceville, Franklin, Suffolk, Norfolk. Landing fields are not numerous, but they can be found here and there if one flies at about a 4,000′ altitude. There is an excellent field at Franklin, Va., at the intersection of the Southern with the Seaboard Air Line. It is quite large and smooth, and there are a number of other good fields in the vicinity.

Generally no place for fast ship, though J.N's can find some fields.

Washington

Country around SPOKANE varies considerably in character. Taking an arc due west of SPOKANE to a line southwest from Spokane, the land between this city and the COLUMBIA RIVER is a very fine section to fly over. It is flat agricultural land, found in large fields from quarter sections to sections.

COLUMBIA RIVER—there are some low ranges but from 5,000′ to 6,000′ altitude a ship can safely and easily glide into YAKIMA and ELLENSBURG VALLEYS. The former is flat, but found in small tracts; the latter is open but more rolling. From YAKIMA and ELLENSBURG to the coast is across the Cascades and is suitable for high altitude trips. The best route to the coast from SPOKANE is above PASCO and down the Columbia River to PORTLAND. The western half of this is not so good. Fields are very few and small.

Swing from the southwest to the south, it includes the SPOKANE and WALLA WALLA route. The country is still open but becomes more rolling. The best landing fields being on the high ground and sometimes on slopes, but this calls for landing up-hill rather than to the wind. From WALLA WALLA south to BOISE, Idaho, is rough and hilly, timbered country. East and north from SPOKANE, country is mountainous and heavily timbered, the worst kind of flying country; only the SPOKANE VALLEY west to COEUR D'ALENE and the COLVILLE VALLEY north to COLVILLE is ideal territory to fly over.

THE INLAND EMPIRE consists of that territory lying between the two ranges of the Rockies; The Cascade Range on the west, which is about two hundred miles from SPOKANE, and the Bitter Root Mts. on the east, which are about forty miles away. On the north there are valleys formed by several low ranges of mountains which extend south from the line. One may land almost anywhere in these valleys. On the south as far as the Oregon Line is a rolling wheat country.

All of this Inland Empire lies at an altitude varying from 1,500′ to 2,500′ above sea level and except on the mountains, there is practically no wooded land and not much rocky country. In general, one could describe this whole territory as rolling wheat land, with emergency landing fields everywhere. During the past year there have probably been fourteen forced landings made by either pilots or private owners operating out of a field owned by a large company here. All of these landings were without accident or damage to the plane.

The usual routes of air travel in Western Washington are as follows:

From SEATTLE to BELLINGHAM by way of EVERETT or SNOHOMISH and MT. VERNON to BLAINE; or across the south to VICTORIA, B. C.

From SEATTLE or EVERETT across the SOUND to PORT ANGELES and PORT TOWNSEND.

From SEATTLE to TACOMA, thence to CENTRALIA; from CENTRALIA to KALAMA, thence to PORTLAND, Oregon.

From SEATTLE to GRAYS HARBOR by way of TACOMA and OLYMPIA; sometimes calling at CENTRALIA or CHEHALIS.

From SEATTLE eastward the common route is to Cle Elum by way of SNOQUAIMIE, NORTH BEND and SNOQUAIMIE PASS, thence to YAKIMA by way of ELLENSBURG, or to WENATCHEE direct from Cle Elum or to WENATCHEE from ELLENSBURG.

During the season from June first until November first landing places can be found on all of these routes west of the mountains; but for the remainder of the year most of such landing places, with the exception of the vicinity of TACOMA, are very wet and some of them even under water. From Cle Elum eastward, landing places can be found the year round. From Seattle to Cle Elum the only available landing places are small cleared fields which are under cultivation, and would not ordinarily be considered as available at all in more favored sections of the country. This route also crosses the Cascade Mountains.

Landing places are easily accessible on practically all routes east of Columbia River; but the great difficulty encountered in Eastern Washington is not the matter of adequate landing facilities but air conditions are unfavorable to low-powered machines, due to the barren nature of the country and the high temperature encountered there during the summer months.

West Virginia

From YOUNGSTOWN, Ohio, to PARKERSBURG, W.Va., via MOUNDSVILLE, W. Va., fair for 25 miles out of Youngstown until strike Ohio River; then very bad to Moundsville. Good field there but high hills on both sides. A pilot should be on the look-out here, as a ship was wrecked here by hitting a very high wire and there are high poles. After leaving here, a forced landing can be made on a small island in the river near SISTERSVILLE; it does not look good from the air but it is a very good field. The entire country all down this valley is rolling and shows no good fields. At PARKERSBURG the country is just fair.

Wisconsin

Western Wisconsin on the line from the Twin Cities to Chicago is very bad and dangerous flying country.

Southern Wisconsin is good but parts of the eastern and central country are bad, hills and trees. Very uncertain air has been encountered there, especially when flying low, probably due to the roughness of the ground.

From CHICAGO to MINNEAPOLIS-ST. PAUL, over LA CROSSE, Wis.,

the route lies over fairly level and open territory as far as the Wisconsin River, from there on northwest the country grows rapidly rougher and with heavy timber till the last fifty miles out of La Crosse has only scattered possible landing fields. From La Crosse up the river valley or over the highlands to the west of river, possible landing fields are available from an altitude of two to three thousand feet. The territory from the Wisconsin River northwest has days when low fog and rain make it impassable but these days are actually not numerous. In winter time this route suffers from very cold weather and blinding snow storms, some of which are practically impassable. This route does not suffer from prohibitive winds.

The route between MILWAUKEE and CHICAGO, and MILWAUKEE and GREEN BAY is almost ideal from an emergency landing field point of view. The most level field in Milwaukee County is the field 5 miles south of the Milwaukee Post Office and 1½ miles west of Lake Michigan.

One route from Milwaukee to Chicago follows the C. M. & St. P. R. R. as far as RACINE, which is past two miles west of the City Hall. KENOSHA is past 2½ miles and WAUKEGAN 3 miles. Land at the Air Mail Field at Maywood, Ill., also known as the Checkerboard Field. All along the route there are many level fields which have ample landing facilities. The country from Milwaukee to Green Bay is almost similar although slightly wooded in small sections.

The southwest corner of Wisconsin—Grant Co., quite hilly and bad, also Lafayette and Iowa. Green Co., good—Dane Co., good—Rock Co., good, and so is whole S. E. corner; up around Portage it gets poorer. Monroe, Juneau, Adams, quite good—Jackson Co., very poor. Eau Claire is a bad town to fly out of. Dunn Co. quite good, and generally the country east of St. Paul is very spotted. Some good and some quite bad.

Wyoming

SCOTTS BLUFF, Nebr., to CHEYENNE, Wyo., level to rolling, safe alt. 2000′, bad snow storms in winter months, sudden; air fair. CHEYENNE to SHERIDAN, mostly mountainous, unsafe "Little Big Horn Mt."

Bighorn to Sheridan, rolling, safe alt. 3000′, air bad. Sheridan to Dayton, rolling, quite a lot irrigation at Dayton. Sheridan, to Ranchester, gets rugged, rolling. Sheridan to Crawford, Nebr., rolling, a couple five-mile divides, air bad. Sheridan, fair at Crawford.

Valentine to Thedford, valleys with strips of sand hills, safe alt. 3000′, air fair. Thedford to North Platte, sand hills.

From Colorado Springs, Colo., to Cheyenne, Wyo., a short flight of two hours, is over flat country with the exception of only a small range near Colorado Springs.

The eastern half of this State is ideal flying country, practically one large landing field—rolling prairies, the greater part of it never having been broken, and the fences are few and far between. The western half, however, is mountainous and hazardous.

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut Street
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
J. SIDNEY OWENS, *2d Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. BAMBERGER
CHARLES L. HOWER
GEORGE S. IRELAND
FRANK A. L. LEAHY
JOHN W. PRATT
D. J. SPENCE, JR.
A. STANLEY TRUSCOTT

ALMOST interesting lecture, to which the members of the Club were invited, was delivered at the Franklin Institute on October 6th on Aeronautic Research by Joseph S. Ames, Professor of Physics, The Johns Hopkins University and Director, Office of Aeronautical Intelligence, National Advisory Committee for Aeronautics. Three types of aircraft were described: the aeroplane, the airship and the helicopter, and the explanation of their power to fly was given. The principal scientiffc problems arising in connection with the various types were stated and the method of solution described. Attention was called to the importance of both wind-tunnel experiments and actual flying tests.

The lecture, being fully illustrated by lantern slides, was most entertaining and a large audience was in attendance. The courtesy extended to the Club whereby the members are enabled to attend these lectures is much appreciated and the thanks of the Club is given to The Franklin Institute for the invitations which have been sent the members.

Representatives of the Industrial Relations Committee of the Philadelphia Chamber of Commerce flew to Washington on September 22nd, where they were received by President Harding. Comfortably seated in the large Fokker monoplane, the party of six passengers left the Bustleton field shortly before nine o'clock and arrived at their destination two hours later. The large plane, known as the "Half Moon," is of the enclosed cabin type with separate seats for the occupants, also a luggage compartment. It was piloted by Bert Acosta, a chief test pilot during the war.

"We had an excellent trip," said Acosta. "We flew low and everybody enjoyed the scenery. The weather was clear, permitting a good view of the country. The ladies particularly expressed their delight at flying, and remarked on the comfort as well as the thrill it afforded."

The large plane created much interest during its stay in Philadelphia, being of a new type and construction, the wings being covered with plywood instead of fabric and of the cantilever form without any external wires or bracing. It is hoped that some time in the near future Philadelphia will have a landing field of sufficient size to permit these commercial planes to readily land within the city limits close to transportation to the central parts of the city instead of being forced to the small unsuitable emergency fields on the outskirts.

The new six-passenger flying boat constructed for the Secretary of the Navy at the Naval Aircraft, Philadelphia, left its hangar on September 21st for its initial trip to the Navy air station just across from Washington, where it will be kept subject to the order of Secretary Denby. It was piloted by Commander Richardson and Lieutenant McFall of the Navy Aircraft Division, who were accompanied by four naval officers as passengers. Its total capacity is ten.

The machine which is very similar to the standard navy F5L type, has a span of 105 feet, weighs 14,000 lbs. completely outfitted, and is equipped wtih two Liberty motors and has a speed of from sixty to ninety miles an hour.

Ample space has been provided in the machine for passengers and crew. There are two compartments, one a large observation and pilot room with port holes and the other a well furnished cabin with chairs and table.

The funeral of Lieutenant Wistar Morris, war aviator, whose body arrived recently from France, was held with military honors. Lieutenant Morris was a sophomore at Princeton at the outbreak of the war. He enlisted in the 12th Aero Squadron, which trained at Princeton, and went to France in the fall of 1917. During the following year he made a splendid record flying on the western front. He met his death September 29th, 1918, when his plane was brought down in the enemy lines by German anti-aircraft guns.

A most cordial invitation has been extended by the Philadelphia Section of the American Society of Mechanical Engineers to the officers and directors of the Club to be present at the meeting of November 22nd as guests of the A. S. M. E. This is the annual smoker and get-together meeting of the Philadelphia Section and will be held at the Adelphia Hotel (Roof Garden). The speaker of the evening will be Commander H. C. Richardson, U. S. N., his subject being "Experiences on the NC3 during the Trans-Atlantic Flight."

A real "old time" meeting of the Club will be held at the headquarters, 1026 Walnut St., Philadelphia; evening of October 21st, at 8 P. M. This is to be a regular get-together meeting of old and new members, past and present officers, and a fine time is anticipated. At 6.30 P. M. a special dinner will be served to the members, who should advise in advance so that proper reservations can be made.

Major Joseph A. Steinmetz, president of the Club, has just lately returned from overseas and is to be the dinner guest. At the meeting he will tell all about what is doing in aviation in Europe and will have on display some interesting air mail letters from his historic collection. There will be reports of Committees and other matters for the consideration of the members.

The attention of all who are interested in aviation is again called to the fact that the meetings of the Aero Club of Pennsylvania are held at the Club room, 1026 Walnut St., the third Friday evening of each month, and that they are cordially invited to attend and join in the discussion of the aeronautical topics held by the members. Come to the meetings and get acquainted and make application for membership.

W. H. SHEAHAN,
1st Vice-President.

NAVAL and MILITARY AERONAUTICS

Airship C2 at Aberdeen

Through the efforts of the Ordnance Department of the Army, an airship hangar of sufficient capacity to house a C-Type airship of approximately 108,000 cubic feet of gas capacity and having a useful lift in excess of 2,000 pounds at bombing altitudes, has been erected at Aberdeen, Md. At the present time the Arishp C-2 is housed in this hangar and is successfully operating therefrom. A suitable bombing rack and suitable sights are being installed on this ship for the dropping of bombs up to 1,000 pounds in weight.

The purpose of the Ordnance Department in requesting the assignment of this ship to Aberdeen was to carry on extensive tests with bombs. Being able to hover and thereby capable of making a very high percentage of hits, the airship in this respect is superior to planes which have heretofore carried out experimental bombing with large sized bombs.

Movement of Air Service Troops

Orders have been issued relieving the 1st and 5th Squadrons, Air Service, from temporary duty at Langley Field, Va., and directing their return to Mitchel Field, Long Island, N. Y. These two squadrons present 6 officers and about 75 enlisted men.

Assistant Secretary of War Visits Camp Knox

Assistant Secretary of War Wainwright, on September 19th, inspected the 31st Balloon Company at Camp Knox, Ky. This was a tactical inspection, the balloon being in the air, and the men were inspected in their tactical sections. At the conclusion of the inspection, the Assistant Secretary went aloft with Lieutenant Farnum to look over the camp. A 20-mile trip was made, and a comprehensive study of the territory was reported.

Training 170 Flying Cadets

The Air Service has been authorized to make preliminary arrangement for the securing and training of 170 additional flying cadets. Sufficient money is available out of the current fiscal year's appropriations to provide pay for that many and other expenses incident to their training, and there is sufficient aeroplane equipment. The only difficulty lies in the lack of funds for transportation of the candidates from their homes to the flying training centers. The Air Service is informing those who have made application for the training, and it is expected by January 1, 1922, or soon thereafter, funds will be available for their transportation.

Free Balloon Flight Over Manila Bay

Floating in Manila Bay for over two hours in an almost submerged basket, with a half-inflated balloon acting as a sail and dragging the basket through the water at the rate of about ten miles an hour was the exciting experience of a party of three aeronauts who attempted a free balloon flight from Corregidor Island to Manila on August 10th last.

An interesting report covering this flight has just been received from Lieutenant W. A. Gray, Commanding Officer of the 27th Balloon Company, stationed at Kindley Field, Fort Mills, P. I., who was the pilot of this balloon.

The equipment used for this flight was an old leaky Type R balloon, which had been condemned as unserviceable for observation purposes, and a basket equipped with Kapok flotation rings. The purpose of the free balloon flight was to give the observers practice both in handling and landing a Cacquot type balloon in case of an accidental breaking of the cable.

In about a ten-mile breeze blowing towards Manila City, the balloon "weighed off" at 9:25 a. m., with 12 bags of ballast, the crew, in addition to Lieut. Gray, the pilot, being Warrant Officer R. E. Lassiter, aide, and Captain I. H. Edwards, 2nd Aero Squadron, passenger. When about five miles from Corregidor, the wind died down entirely and numerous clouds were encountered at an altitude of two thousand feet. Whenever a cloud would pass over the "bag" and cool the gas—in addition, the cooling effect of the water at an altitude of six hundred feet had also to be considered—the balloon would then descend rapidly, necessitating using ballast. Approximately, after five minutes of a cloud the sun would appear and the balloon would then ascend rapidly until the automatic valve would function, thus causing the "bag" to again descend to where some other clouds would be encountered, causing further descent. It seemed impossible to get and maintain an equilibrium, which was possibly due to the weather conditions, the automatic valving and the porous fabric of the balloon. In addition to this, more ballast was used than actually necessary, due to the fact that the only instrument used was an altimeter, which was at least 200 feet slow in registering.

About an hour and a half after the beginning of the flight the balloon was in the middle of Manila Bay, some eight miles north of Corregidor, and it was seen that the ballast would not hold out much longer. Preparations were therefore made for coming down in the Bay. The inside lining of the basket was ripped out, in order that when landing the water would not force it up and throw the passengers out. Meanwhile, the occupants of the balloon undressed. After two hours and fifteen minutes in the air, and with only one bag of ballast remaining, the balloon slowly descended and the basket landed in the water. The drag rope, weighing about sixty pounds, was still rolled up and tied to the basket, but as soon as the basket hit the water it was cut off altogether. No sooner was this done than the balloon began to ascend again. The valve rope was pulled, stopping the ascent when an altitude of 400 feet had been reached. Again the balloon descended and with the remaining bag of ballast an excellent landing was made. The balloon still had a large quantity of hydrogen, only the tail being in the water, and, as there appeared to be no danger of it falling and enveloping the basket, the rip panel was not pulled. The water meanwhile was within a foot of the top of the basket and just below the flotation rings, but it was apparent that the hydrogen remaining in the top of the balloon was what actually kept the basket afloat.

It was fully believed that the plight of the balloon could be easily seen from Corregidor, so that no anxiety was felt for the first forty minutes. When, however, no boat was seen leaving the island, it began to appear as though no help was to be expected from there. There were several small fishing smacks about a quarter of a mile from the balloon, and although repeated signals were sent to them they did not respond. After about an hour and a quarter of aimless drifting, a breeze blew up, and the half-inflated balloon acting as a sail began pulling the basket through the water at the rate of about ten miles an hour. When the basket began moving, one side of it went under water, but all concern as to safety vanished, for with the wind holding out it was only a question of time before Manila would be reached. After being in the water about one hour and fifteen minutes, a boat was seen to leave Corregidor, and one hour later, or at about two o'clock, this boat picked up the balloon, basket and passengers, fifteen miles from Corregidor. It is estimated that about six miles were covered in sail boat fashion.

The results of this flight were more valuable than if Manila Bay had been crossed and land reached, as it proved that there is not any danger in a balloon of this type falling on the basket when landing in water and that, so long as any hydrogen remains in the "bag," it should not be ripped. This flight also demonstrated that when flying at this station baskets should be without an inside lining and should be equipped with flotation rings, or life preservers, and two straight bladed knives.

Helium for Airships

(*Concluded from page* 203)

liquefaction of impurities from the Helium. Dr. Richard B. Moore, Chief Chemist of the Bureau of Mines, is in charge of this plant, assisted by Mr. Ferris of that Bureau, the latter being stationed at Langley Field. The plant is operated in conjunction with the hydrogen plant at this station.

It is anticipated that both the Railroad Repurification Plant and the plant at Langley Field will be ready for operation about the first of next year. The successful operation of these plants is assured, inasmuch as the laboratory designs which have been tested out have proved very successful.

FOREIGN NEWS

Railway Survey by Air

There can be no question but that the aeroplane and the airship can render immeasurable service to civilization by the rapidity and certainty with which they can open up communications in unsettled country, and by ground surveys of tracts across which it is desired to establish roads and railways in virtually unknown and unexploited lands. Already a great deal has been accomplished in Canada and other sparsely populated countries by way of forest surveys, which have brought in a few days information and knowledge which it would, without the assistance of aircraft, have taken months to gather, even if it were possible at all. Fresh ground is now being broken in Australia by an explorer, Mr. Francis Birtles, who has undertaken an aeroplane journey across the center of the Continent. His route takes him from Adelaide north to Oodnadatta and thence to Alice Springs, which lie at the foot of the Macdonnell Range almost in the center of Australia. He is to keep a lookout en route for pastoral, agricultural and mineral areas, and is to carry out a rough aerial survey for the best route for the proposed railway from the south to the north of the Continent. He is also to fly across the inland sea known as Lake Eyre, where it is believed there may be fertile islands. He expects to gain in five weeks more information than could the best equipped land exploration expedition in a year.

We do not doubt for a moment but he will. So far, we have very little to guide us in the way of actual survey work of the kind upon which this Australian air explorer is now engaged. But we have the records of many difficult reconnaissances of almost similar character carried out during the War in the remoter theatres of hostilities. East Africa and Mesopotamia provide many such examples of excellent work done and valuable information regarding the terrain obtained by officers of the flying services. Almost invariably this information was greatly more reliable than the best maps obtainable, and this quite often in districts which have been at least partially surveyed from the ground. This being so, there is every reason to believe that such cases as the Australian survey now in progress will result in sufficiently accurate data being obtained to enable the authorities to decide upon the route for the Transcontinental railway without going to all the expense, trouble and delay of carrying out a detailed ground survey on more orthodox lines. What this means in the quicker opening up of the country to civilization and settlement is too obvious to need laboring. On the face of it, a year will be saved in getting to work, and in such enterprises as that contemplated a year counts for a great deal. And the aeroplanes and the airship—for both have their distinct spheres of usefulness in such tasks—are only now beginning to demonstrate their possibilities in this direction. We can safely look forward to the time when all preliminaries of survey work for the opening up of new countries will be accomplished by the aid of aircraft. The aeroplane will be followed by the airship, carrying a survey party whose duty it will be to dot the i's and cross the t's of the first survey. The saving of time and money will be enormous, let alone the saving expressed by the bringing into production of new areas and fresh countries.

Conquest of Arabian Desert by Aircraft

Heretofore the Arabian Desert had been regarded as a bar to direct communication between the Mediterranean and the Persian Gulf. Aeroplanes, instead of crossing it, flew on a semi-circular course round its northern extremities, and so covered many more miles than actually separated the aerodromes on its eastern and western sides. The length of the new route is 580 miles, and the line it follows passes through Amman in Transjordania and Kasrel Azrak, where there are now landing grounds, and then in an almost straight line crosses the Arabian Desert to Ramadie on the Euphrates and leads thence to Baghdad.

The Royal Air Force have carried out the survey. They had the cooperation of the Emir Abdulla in establishing at Amman an advanced base 45 miles east of Jerusalem. There in May was assembled a flight of aeroplanes, armored cars lent by the British War Office, and desert tenders fitted out with wireless telegraph apparatus.

The locating of the first 150 miles of the route was done with little difficulty. Then the ground parties began to find their work more and more toilsome, until 160 miles from their starting point they struck a vast tract of rough lava beds. Scattered across this tract, which was intersected by deep wadis, were enormous boulders. But a way out of the lava bed had to be found, and when those working on the level were well nigh baffled, and when the growing heat of June added to the hardships under which they labored, news at length came by wireless from the scouting aeroplanes far ahead that a way out of the wilderness of stone and dry stream beds had been found. That was on June 16th. The ground parties forthwith set to work anew and forced a passage through 10 miles of heart-breaking country out into the desert again, where they struck land that was comparatively easy to work. Four days later ground connection was made with Baghdad when the cars arrived at the emergency ground at El-jid, 300 miles from Jerusalem. Operations were pushed on from the Baghdad side, and on June 25th Ramadie was entered by air and land. Baghdad was entered on the following day.

Thus the route was roughly laid out. Work is now going on in perfecting the emergency landing grounds, and in making permanent the ground organization along the track.

Japanese Activities

Japanese newspapers report that the Army Balloon Corps will participate in the maneuvers with the Imperial Guards Division at Suson near Mt. Fuji from September 12th to the 15th. The R model captive balloon will be used for observation purposes. Five officers of the Balloon Corps and several additional observation officers will take part.

Ten civilian aviation students at the Army Flight School at Tokorozawa graduated August 31st. This is the first civilian class at Tokorozawa, but it is expected that these classes will be continued regularly in the future.

A small, non-rigid type airship was recently purchased by the Japanese government from the Vickers Company, London. The airship performed its final test of four hours continuous flight on April 27th, successfully, only 30 men being required to handle it, and it ascended and descended very rapidly. The airship is described as having one "ship" in the center, capacity 5 men, and with a speed of over 50 miles per hour.

The graduation flight of the Naval Air School at Kokosuka took place on July 10th. The course was from Oppama (near Yokosuka) to Shinmaiko and return, six graduates taking part. Only one machine reached the latter place, the other planes being forced to descend into the sea. Bad weather conditions prevented this one plane from attempting the return journey.

Lisbon-Paris Service

A regular daylight aeroplane service between Paris and Lisbon is announced by the Portuguese Company of Aerial Navigation for this winter. Next year it is proposed to extend the line to London, Brussels, Amsterdam and Berlin.

The Germans in the Netherlands

Advertisements recently appeared in the leading Dutch newspapers offering for sale 36 new German aeroplanes, of which eleven are said to be ready for immediate use. The advertisements state that the machines are equipped with 200 h.p. Benz and 120 h.p. Mercedes engines, and that all spare parts are also available.

Swedish Aero Show in 1923

According to *Svensk Motortidning* it is intended to hold an Aero Show in Göteborg, Sweden, in 1923. The time tentatively fixed for the exhibition is July 7-31. It is stated that the Society of British Aircraft Constructors and the Chambre Syndicale des Industries Aéronautiques have been approached on the subject of participation in the exhibition and have given favorable replies. It is also hoped that Italy, Germany, Czecho-Slovakia, and the United States will participate.

Australian Air Mail Services

The first of the series of Aerial Mail Services in Australia under control of the Commonwealth will be inaugurated on October 30, or if subsequently fixed by the Minister of Defence not later than November 30. While a limit of £25,000 has been placed by the Government on the total amount of any tender, tenderers are to be given the option of forwarding proposals to maintain a greater or less number of trips than is provided in the conditions-contract. Tenderers must name two guarantees to the amount of £5,000 for safety of mails and fulfillment of contract. Tenderers must specify the class of machines, and numbers proposed to be provided, with their speed, radius, petrol consumption, carrying capacity, etc. The scales of charges for passengers and freight will be subject to the Minister's approval.

Helicopterist's Accident

From France it is reported that de Payer has had an accident while testing a helicopter of his own design. The report states that something went wrong when the machine was at an altitude of about 200 metres. (Looks like a record for helicopters.) The machine did not drop at once but swayed about for nearly five minutes, the inventor evidently trying to right it. Finally it crashed and the inventor sustained severe injuries.

The Coupe Michelin

Several attempts have been made by French and Italian pilots to improve upon the performance of M. Poiree on a Caudron C. 60. Pelletier d'Oisy made a try, but had to give up at Toulouse. In Italy the coditions are more or less the same, except that Italian pilots are at liberty to choose a sea circuit for their attempt if they prefer.

The following attempts have been made by Italian competitors: Col. Armani on a B.R. had to give up after covering a little over half the total distance of 3,000 kilometres. Capt. Diziano crashed on Mount Gandino. Capt. Martinetti it appears has succeeded in completing the course, and, subject to homologation by the French Aero Club, he seems to have improved upon Poiree's performance, having covered the 3,000 kilometres in 35 hours, while Poiree took 37 h. 23 mins.

Commercial Aviation in France

During the course of an interview with a correspondent of the London *Morning Post*, M. Laurent Eynac, the French Air Minister, remarked that the development of aviation in France, especially commercial aviation, has been most remarkable lately. There are already organized six regular aerial lines for the carrying of goods and passengers and, so far as air transport is concerned, France is ahead of all other nations. In May next a new aerial line, Paris to Amsterdam, will be inaugurated.

Aircraft are especially useful on account of the saving of time, M Eynac stated. Thus, it takes more than nine hours to go from Paris to London by train and boat, but by taking the aerial mail one can be in Regent street four hours after having left the boulevards. By air, Brussels is only two hours and a half from Paris, and Strasbourg only three hours and a half. Prague is seven hours from Paris and one can reach Morocco after a thirteen hours' flight, while the most rapid ship takes four days. Railways take ten hours to go from Bayonne to Bilbao; a motor-car will make the same journey in five hours, but a seaplane unites the two towns in 55 minutes.

Another factor of paramount importance to the future development of aircraft is that of security. The results already obtained entirely guarantee the security of passengers. During the year 1919-1920, 1,900,000 kilometers (1,180,603 miles) have been covered by the flight of French aeroplanes. Of this total there were only 7 killed and 7 wounded, that is to say, an average of one killed and one wounded per 170,000 kilometers (105,633 miles) flown. Consequently, it is not surprising to notice the constant development of aerial transports in France. The transport of passengers has greatly developed. Only 960 persons traveled by air in 1919; the number of passengers amounted in 1920 to 6,750. This year during the month of March 665 people traveled by air mail. The carrying of goods has similarly progressed; 13,900 kilograms were carried by machines in 1919, while the total commercial transport amounted in 1920 to 103,330 kilograms (227,739 lbs.) This last figure includes a great many parcels sent from Paris to London by the dressmakers and milliners of the rue de la Paix, who utilize the plane extensively in making their deliveries. The value of their consignments on the line Paris-London during the year 1920 exceeded 16 million francs, and this figure will be largely surpassed this year.

M. Eynac, in conclusion, states that he feels sure that aircraft will prove in the future a most important factor for promoting good entente and solidarity among the nations.



Fokker Model Built by Bruce Mapes

FOLLOWING the outlines published in the November 4th 1918 issue of AERIAL AGE and those on the model page of August 22nd, Mr. Bruce A. Mapes of Brooklyn has built one of the neatest flying scale models ever presented. As the intention was to make the model even more realistic than that shown on the model page last summer, the builder has worked into the design a great many constructional features that appear on the real plane. Naturally no attempt was made to sacrifice detail for the sake of weight, and although long flights cannot be made, the fine appearance is ample reward for the work put on it.

Here is a list of dimensions of the model:

Dimensions

Upper wing span	44⅜ inches
Lower wing span	30½ inches
Chord—upper wing	8 inches
Chord—lower wing	6⅜ inches
Gap between wings	5⅞ inches
Chassis wing span	7¾ inches
Chassis wing chord	3½ inches
Overall length of fuselage	32¾ inches
Height overall	15¼ inches
Propeller diameter	13¼ inches

Wing Construction

The wings are built up with ribs of balsa wood, the curve made to scale taken from the Fokker wing curve. There are 29 ribs in the top plane.

The front main spar is tapered and hollow, just like the full size beams used on the real machine. The spar is built up of 1/16 inch by 1 inch for the sides and 1/16 inch by ⅜ inch for the top.

Rear spar is an "I" beam, ⅜ inch by ¼ inch, tapered slightly at the ends.

Leading edge of white pine, ⅛ inch by 1/16 inch. Trailing edge is 3/32 inch round reed; the "scalloped" effect is accomplished by steaming and forming the curves.

The lower wing is made similar in construction to the upper, except that it is made in two pieces instead of one; this was done so the lower wings could be taken off easily, by means of fittings attached to the fuselage.

Both the body wing-struts and the *N struts* between the wings are made of ¼ by 5/32 inch pine, streamlined. Simple U fittings, attached to wing spars, permit the struts to be removed and attached readily.

The Fuselage

Square 5/32 inch longerons are used to form the body. The turtle-deck is made with a balsa wood framework. The nose-piece, including the radiator, is of balsa formed correctly to scale. For the radiator filler cap, a bicycle spoke nut is inserted at the top, giving a realistic effect.

The motor-stick bracing is arranged in such a way that none of the strain of the rubber elastic "motor" is taken by the balsa nose-piece.

The propeller is 13¼ inches in diameter. Propeller shaft is a ⅛" solid turned bearing. About 50 feet of ⅛" flat rubber is used for the motive power.

Tail Group and Controls

Ailerons on the top wing are connected with a control stick by waxed cords running through the wing and operating like real controls.

The tail group is built up in the standard fashion, of ⅛ inch square wood for the framework and 3/32 inch reed for the outline.

Elevators are connected to the control stick. A rudder bar works the rudder. The tail skid is made of ⅜ by ¼ inch white pine, streamlined. It is shock-absorbing.

Landing Gear

The landing gear is built up of ⅜ by ⅛ inch spruce, streamlined. The small chassis wing, characteristic of the Fokker planes, is located between the two landing gear Vees. Ribs in this wing are of balsa, with three beams ⅛ inch square running lengthwise through them. The leading edge is ⅛ inch square and the trailing edge ⅛-inch square.

Shock absorbers have been provided for the axle and wheels, everything being enclosed in the small wing. The wheels are 4 inches in diameter.

Covering

Covering is with bamboo paper, doped and finished in black and white.

Aeroplane Thrust Compared with the "Pull" of Other Vehicles

THE thrust necessary for propelling an aeroplane is much greater than the "traction coefficient" or "draw-bar-pull" of other vehicles of locomotion according to F. Bedell, author of "Airplane Characteristics." In an aeroplane, wing-resistance alone is, let us say, from 6 per cent. to 10 per cent. of the weight of the machine (corresponding to L/D (lift/drift) = 16.6 to 10). To this is added the parasite resistance, making the total resistance or thrust, in some common types of aeroplane, from 10 per cent. to 15 per cent. of the weight; that is R/W (resistance/weight) = 0.10 to 0.15.

The traction co-efficient of water craft is less than 1 per cent. The traction coefficient of trains on level rails is between 1 and 2 per cent., and of road vehicles on level pavement only a little more. These values, however, are increased by a grade or bad road surface so as to equal or even exceed 10 or 15 per cent.

In the matter of low thrust or traction coefficient it is seen that the aeroplane cannot compare favorably with other vehicles. It must be remembered, however, that an aeroplane travels at a much higher velocity than other vehicles and that, for the aeroplane, the air is a universal right-of-way, extending everywhere, always ready without cost of construction or of maintenance. These advantages make the aeroplane superior for its special purposes.

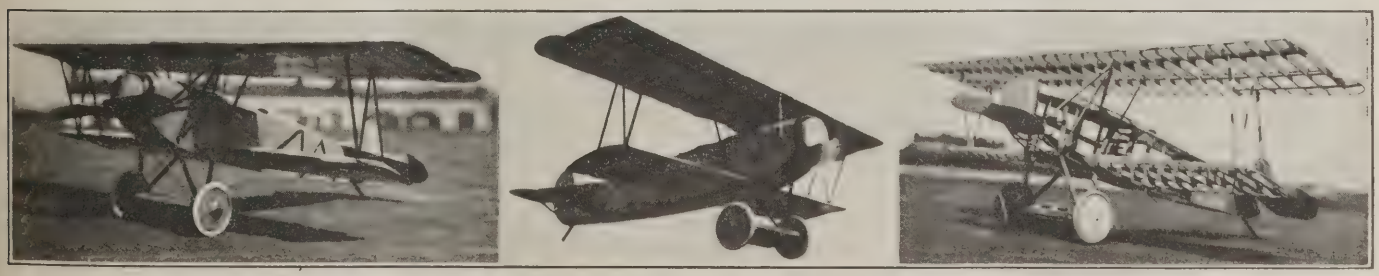
Power and Weight of Aero Engines

THE original engine of the Wright Brothers, used in the first aeroplane flight of 1903, gave only 12 horsepower with a weight of 12.7 pounds per horsepower. The development of the aeroplane engine since then, until the Liberty motor (used in 1918) is shown by the following table.

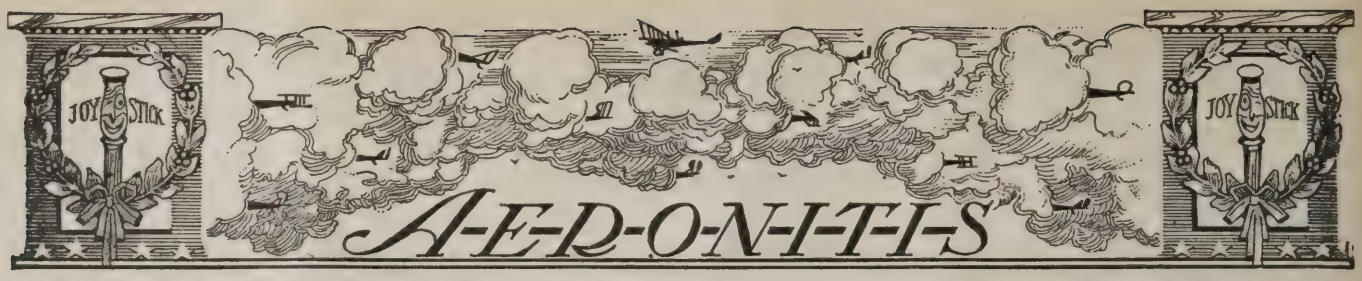
The figures, except for the first and last columns (Wright and Liberty motors) are average values of principal engines for each year:

Year	*1903*	*1910*	*1914*	*1915*	*1916*	*1917*	*1918*
Horsepower	12	54	112	133	185	243	450
Weight, lbs.	152	309	437	512	570	693	825
Lbs. per h. p.	12.7	5.7	3.9	3.8	3.1	2.8	1.8

Each year aeroplane engines have been made of greater power and less weight per horsepower. Although other types of engine may hereafter be introduced. Although other types may be looked upon as *the standard* type for aeroplanes.



A flying scale model of the Fokker D-7 Single Seater, built by Bruce Mapes from Aerial Age plans. The views show the skeleton frame work during construction, the completed model, and a snapshot of the machine in flight



X. Y. Z.

(This might have been dedicated to Thomas A. Edison.)

How much did Philadelphia Pa?
Whose grass did K. C. Mo?
How many eggs could New Orleans La?
How much does Cleveland O?

What was it made Chicago Ill?
Twas Washington D. C.
She would Tacoma Wash., in spite
Of a Baltimore Md.

When Hartford and New Haven Conn.
What reuben did they soak?
Could Noah build a Little Rock Ark
If he had no Guthrie Ok?

We call Minneapolis Minn.
Why not Annapolis Ann?
If you can't tell the reason why
I'll bet Topeka Kan.

But now you speak of ladies what
A Butte Montana is.
If I could borrow Memphis' Tenn.
I'd treat that Jackson Miss.

Would Denver Colo cop because
Ottumwa Ia dore
And, though my Portland Me doth love,
I threw my Portland Ore.

—*Marcus Smiley in Lippincott's.*

My Rotary

By Edward W. Weimar
(In U. S. Air Service)

The hours I spent with that old clock,
Are as a string of oaths to me;
No matter what I did she'd always knock,
My rotary, my rotary.

Each time I flew I said a prayer,
To still a heart with anguish wrung;
One time I tried to zoom some trees, and there
High up I hung, high up I hung.

On promises of what I'd earn!
I got my dad to come across!
My ship and I are broke, and must return
To face the Boss!
Oh Boy!
To face the Boss.

She: Am I the only girl you ever loved?
Breezy: Do you think this is my first shore leave?
She: O, you boys have more fun than we girls. I wish God had created me a little boy.
Breezy: He did. I'm he.—*Our Navy.*

U're Right, Professorette

A wise woman once said there are three follies of men. The first is climbing trees to shake down fruit, when, if they would wait long enough, the fruit would fall of its own weight; second is going to war to kill each other, when, if they only waited, they would die naturally; and third, that they run after women when, if they would not do so, women would run after them.—*Whiz Bang.*

"A woman came into the hospital the other day and she was so cross-eyed that ears ran down her back."
"You couldn't do anything for her, could you?"
"Yes, indeed; we treated her for bacteria."

Priceless Love

When thy little eyes are turned
Sweetly up to mine,—
When my boyish heart has burned
Beating close to thin,—
When the stars that grace the sky
Twinkle in thy hair,—
When thou giv'st a gentle sigh
Whilst I breathe a prayer,—

When I hear thee softy say
"Come and kiss me, Mike!"—
Then I *know* I have to pay
Anything you like.

Sweet Young Thing: Oh, mother, I simply love the sandy coves at Buzzard's Bay.
Mother: Hattie! I won't have you talking about people in such a vulgar way!

"Did either your wife or her car get injured in the accident yesterday?"
"Not very much. Just a little paint chipped off both."

"My dear Mrs. Smith, I think your daughter recites remarkably well, don't you?"
"Yes. All she needs is a short course in electrocution, sort of to finish her off, as you might say."

Doc Horn (*in chemistry*): Boettner, what does A stand for?
Boettner: Just a minute, I've got it on the end of my tongue.
Doc Horn: Well, spit it out, it's Arsenic.

At a Boston Immigration Station one blank was recently filled out as follows:
Name: Abraham Cherowsky.
Born: Yes.
Business: Rotten.

Sweet Young Thing: I can't marry you. You are penniless.
Geo. Young: That's nothing, the Czar of Russia was Nicholas.

He wrote a quatrain on her eyebrow,
A sonnet on her throat,
And her father put a footprint
On the tag end of his coat.

Rastus (*at the dance*): Mandy, is your program full?
Mandy: Lawdy, no, it takes mo' dan two sandwiches an' a cup of tea to fill ma program.—*The Owl.*

Now She Knows

Sapleigh: Too bad about Dapleigh's being arrested for speeding, and getting a week in jail, wasn't it?
Tapleigh: Yes, I'll bet his wife is all broken up over it.
Sapleigh: On the contrary, she says that she is glad it happened.
Tapleigh: How's that?
Sapleigh: She says that now for the first time in ten years she knows where he is nights.—*Princeton Arm-band.*

Vol-steady There Now!

Tom: What's the matter? Lame leg?
Jerry: Nope, boot-leg.—*Penn. State Nitwit.*

Why, the Eye-dea!

Nipp: The oculist says my eyes are strained and I'll have to give 'em a rest.
Tuck: 'S trouble—long studying?
Nipp: Nope, short skirts.—*Dartmouth Ash-receiver.*

UNIVERSITY OF ILLINOIS LIBRARY
NOV 16 1921

AERIAL AGE WEEKLY

VOL. 14. No. 10 NOVEMBER 14, 1921 10 CENTS A COPY



Airscape of the Bowling Green Section, New York City. Photographed for the Fairchild Aerial Camera Corporation by W. L. Hamilton

The Pulitzer Race—Langley Field Wind Tunnel Apparatus—The Maneuvers of Getting Off and Landing

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
criptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

MADE IN ITALY—USED THROUGHOUT THE WORLD

Ansaldo S. V. A. Aeroplanes

Reliability—Speed—Economy

AMERICAN ANSALDO ACHIEVEMENTS

NOVEMBER, 1920—THIRD PLACE, PULITZER RACE.
(A1 Balilla—130 miles 51 minutes 57 seconds)

MAY, 1921—NEW YORK-CHICAGO, 765 MILES, 7½ HOURS.
(A300C Limousine with full load)

JULY, 1921—NEW YORK-CLEVELAND NON-STOP, 4 HOURS.

CLEVELAND-CHICAGO NON-STOP, 3.1 HOURS.

AUGUST, 1921—NEW YORK-SAN FRANCISCO, 4½ DAYS.
Transcontinental made in 34 hours total motor time and
28 hours flight between points.

SEE ANSALDO AEROPLANES AT OMAHA

At our present prices we are offering values which have never been approached in the history of aeronautics. All prices include dual instruction at our field.

SVA Model Nine—two place **$4,900.00**
Model A300-3—three place **$7,500.00**
Model A300C—six place **$11,000.00**
F.O.B. New York.

A Demonstration Will Convince You

AERO IMPORT CORPORATION

1819 BROADWAY **NEW YORK**

WRIGHT PATENTS LICENSEE

November 14, 1921

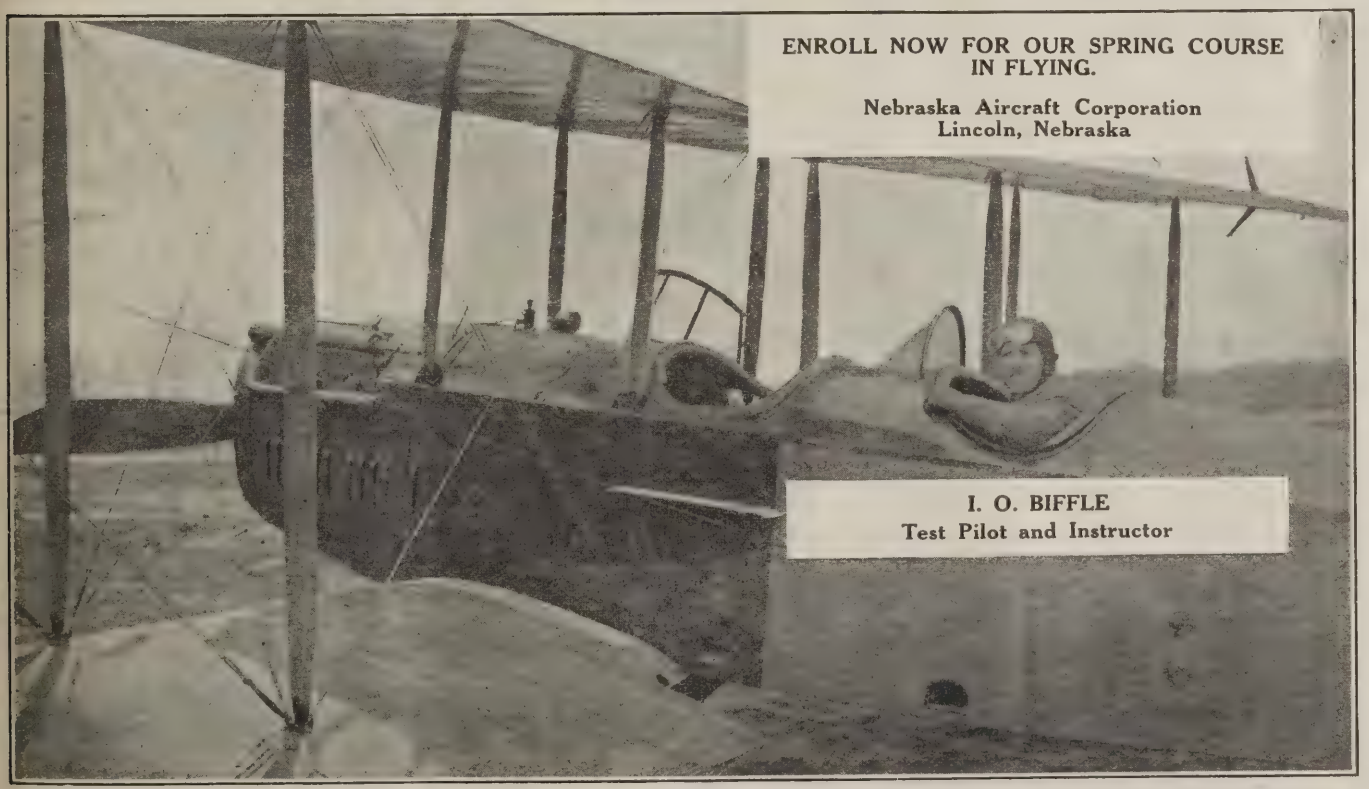
AERIAL AGE WEEKLY

VOL. XIV, No. 10

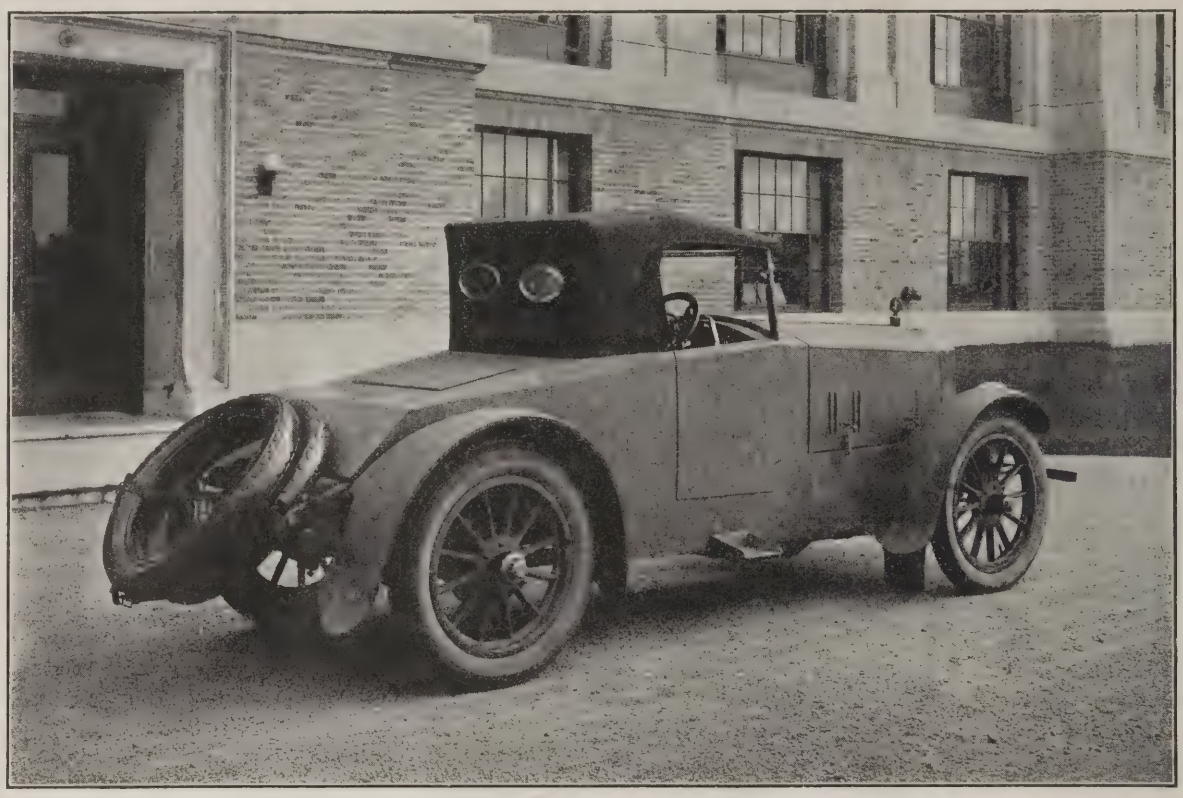
TABLE OF CONTENTS

Wings of the Morning..... 219
The Pulitzer Race an American Achievement..... 219
The News of the Week..... 220
The Aircraft Trade Review..... 221
The Pulitzer Race..... 222
Langley Field Wind Tunnel Apparatus..... 225
A Comparison of Spar Weights of Tapered and Non-Tapered Monoplane Wings..... 226
Carburetion as a Prime Factor in Producing Power..... 227
The Maneuvers of Getting Off and Landing..... 229
Trials of Sperry High-Lift Wings.. 230
Naval and Military Aeronautics.... 231
Foreign News..... 232
Elementary Aeronautics and Model Notes..... 233
Aeronitis..... 234

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.



Complete Course $500.00. $125.00 payable upon our acceptance of your entry. $125.00 per week until course is completed. Each pupil will actually work in every department of our factory gaining thorough knowledge of construction of planes, and assembling of motors. Then competent instruction at the flying field and in the air. Pupils purchasing planes will be credited the full amount of your course towards the purchase price of the ship you buy



AVIATION FANS

build yourself a $10,000.00 automobile chassis with an old high-grade chassis and an overhauled OX-5, and have the satisfaction of driving a personally engineered custom automobile.

Very slight and easily made modifications only are necessary ordinarily on the motor and chassis.

The above photograph shows a Winton, year 1910, chassis with OX-5 motor and special body. Weight fully loaded 3,600 lbs., maximum speed 100 m.p.h. Four speed chassis, 18.3 miles per gallon of commercial gasoline by actual continuous check at 30 miles per hour in high gear without slipping clutch, acceleration standing start to 45 miles per hour in 10 seconds. In three days' city driving ran 145.2 miles on 9¼ gallons of commercial gasoline.

Send self addressed and 4-cent stamped large envelope for general data on above and Marmon installation, or one dollar for detail instructions with photographs and OX-5 booklet.

Curtiss Aeroplane & Motor Corporation

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., November 14, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, NOVEMBER 14, 1921 NO. 10

The Pulitzer Trophy Race an American Achievement

BERT ACOSTA wrote international aeronautic history when he drove the Curtiss-Navy Racer to first place in the Pulitzer Trophy Race on November 3 and established a world's speed record of 176.9 miles per hour. It is a record established by a 100 per cent American aeroplane, and is a timely answer to some of our foreign critics that America is lagging in aeronautic enterprise. The Curtiss and Navy Department engineers who designed and built the winning plane and its motor deserve great credit for this achievement.

The speediest race-flying done by anyone until November 3 was in the Deutsch de la Meurthe contest held at Etampes, France, September 30 last, which was won by Lieutenant Georges Kirsch. Over a course of 186 miles, his speed was 173.1 miles an hour. He flew a Nieuport-De Lage plane.

While aviation enthusiasts at the clubs, fields and factories were eagerly reading the news that Bert—a great favorite hereabouts—had won the trophy, the more important information arrived in a telegram from Augustus Post of the Aero Club of America, who had gone to Omaha to see the race. He made known the fact that the course was longer than it had been supposed to be.

It became known that the course was accurately surveyed by the "chain" system before the race at the instigation of the Curtiss interests, which wanted to be sure of having an absolutely correct line on the flying speed of their ship should it win, which they confidently expected.

Last year's course for the Pulitzer Race—a triangle with the starting and finishing point at Mitchel Field, Mineola—was, it developed afterward, shorter than it was supposed to be. It was planned to be 132 miles in length, but an examination made afterward by the United States Geodetic Survey proved it to be actually only 116.8 miles long.

The winner, Captain C. C. Mosley, U. S. A., who drove a Verville-Packard ship, was credited in the first reports of the race with having averaged 178 miles an hour and with having broken all racing records, the best of them at that time being held by Sadi Lecointe of France, who averaged a trifle more than 169 miles an hour in winning the Gordon Bennett Trophy at Etampes in September, 1920, but a revision of figures showed that Mosley's actual time was only 156½ miles an hour.

Second place in the Pulitzer race this year was also secured by a Curtiss product, the Curtiss Cox Racer, piloted by Clarence Coombs, and the Curtiss C-12 motor installed in the Italian Ballila Scout enabled that ship to make fourth place.

Next year's Pulitzer race is to be flown at Detroit. The flying club of that city was to have held the race this year, but gave it up because it received no assistance from the army or the navy and was fearful it would not get enough entries to make the event interesting. Thereupon the lively young organization in Omaha stepped into the breach, asked for the race, got it and—as Thursday's brilliant performance proved—kept it up to its established high standard of success.

Wings of the Morning

FROM London comes the report that a 150-passenger seaplane is in course of construction, and that next year it will tune up its motors and send its 400-foot span westward at 130 miles an hour, leaving Great Britain at midday and sighting the Statue of Liberty twenty-four hours later. This is quite possible, of course. It is, in fact, inevitable. Science permits it and men wish it, and eventually it will be done. There will be larger motor units accessible to mechanicians, cabins inside the wings (as are promised for the present British machine), steel construction paralleling bridge work, and more speed than we yet dream of.

If yesterday brought news of aerial possibilities from London, it brought news of aerial performance from Omaha. The Pulitzer speed race was held there yesterday, and the Curtiss navy racer was piloted for 150 miles by Bert Acosta at a speed of 173 miles an hour. Two other machines of American make pressed upon him with approximately 166 miles per hour and 156 miles per hour, respectively, for the course. Acosta's performance was not a record; Captain Mosley last year flew at 178 miles per hour. But what yesterday's winner did and what his fellow contestants did indicate the relative permanence of high speed in flying. At the end of the war no machine was credited with a consistent performance as fast as that which took third place yesterday. Today 160 miles an hour is as easy for an aeroplane as sixty miles an hour was ten years ago. High speed, like flying the Atlantic, is inevitable and on the way toward becoming dependable and ordinary, though it is doubtful if the thrills of either will be absent even for the sophisticated next generation.—*Editorial in N. Y. Globe.*



The News of the Week



Bertaud Wins Kansas City Derby

Kansas City.—Lloyd Bertaud, after being prevented by fog from flying from New York, arrived by train in time to win the American Legion Aerial Derby over a 140-mile triangular course. His time was 60 minutes 15 2-5 seconds.

Lieut. J. D. Givens, Fort Sill, Okla., was second. His time was 66 minutes 15 1-5 seconds. Third and fourth places were won respectively by C. B. Wrightsman, Tulsa, Okla., time, 67 minutes, 17 4-5 seconds, and Lieut. Wagoner, Fort Sill, time, 67 minutes 55 1-5 seconds. Fifth place went to Major Lamphier, Fort Sill, Okla., time, 68 minutes, 12 2-5 seconds.

The prizes were: First, $3,000 and the Kansas City Rotary Club trophy cup which to become a permanent possession must be won twice in Legion events; second, $1,500; third, $750; fourth, $500; fifth, $250.

Parachute Record

Kansas City.—Sergt. Encil Chambers of Post Field, Fort Sill, Lawton, Okla., on November 1 made what officials say is the record for high parachute jumping when he leaped approximately 26,000 feet—400 feet less than five miles—from an army plane. The stunt was performed in connection with the American Legion flying meet. The descent took eighteen minutes.

Sergt. Chambers's former record was 22,002 feet. This was later broken by Lieut. Hamilton at Rantoul, Ill., last summer, when he made a jump at an altitude of 23,007 feet. Representatives of the Aero Club of America will send the sealed barograph to Washington to have it calibrated and the official altitude verified.

Both Chambers and his pilot, Wendell Brookley, were equipped with oxygen tanks and special fur-lined clothing. The ascent, according to Lieut. Brookley, took an hour and a half.

When the flyers had reached the "ceiling" Brookley gave the signal and Chambers climbed out on the fuselage. Then he dived head first into space. According to Chambers, he dropped fully 500 feet before his big silken parachute opened.

Chambers said he suffered intensely from the cold during the early minutes of the descent. He said he lighted a cigarette and smoked it during half of the downward journey.

First Airship Arrives at McCook Field

The Balloon and Airship Section of McCook Field received its first airship September 19th. It is a P-B type, non-rigid, manufactured by the Goodyear Tire and Rubber Co., of Akron, Ohio. It was ferried to McCook Field by Lieut. G. W. McEntire, who is stationed at Akron supervising the construction of a larger airship which will probably make a trial flight to McCook Field about the first of the year.

This small airship made an average speed of 44 miles per hour on this trip, averaging 12 miles to the gallon of gasoline, and used less than three quarts of oil.

The airship is to be used at McCook Field to test out various kinds of equipment, now under design and construction by the lighter-than-air Sections.

A recent review of the press reveals the fact that ships of this type are used by motion picture concerns for the taking of aerial scenes, and that two Los Angeles sportsmen flew a Pony Blimp from their home to Catalina Island for a few hours' fishing trip, and brought back their catch without leaving the ship.

Parachute Jumper Drowned

Omaha.—Harry Eibe, employed by a Chicago parachute company, was drowned in the Missouri River November 3, when he landed in the stream after making a parachute jump of 7,000 feet during the international aero congress.

Eibe had been flying with Cyle Horchem of Ransom, Kan. After his leap he evidently realized that he was going to drop into the river unless he changed his course, and he frantically manoeuvred in an attempt to save himself.

Forest Mapping in Canada

Having accomplished by flying-boats (F3's) in a few months what it would have taken years to do had the work been done on the ground, three Air Board officers arrived at Ottawa, Canada, October 25, flying their machines from Sioux Lookout, a distance of 900 miles.

The three officers, Capt. A. W. Carter, Capt. W. G. Boyd, and Capt. Clifford McEwen, have been working north of the Transcontinental Railway, mapping the forest to show the types of timber in Northern Ontario, information that will be of great value to the Canadian Government, and which they have made available in a comparatively short space of time.

The three machines they used in their daily work will be stored at Ottawa for the winter, and the men themselves will remain in winter quarters at Ottawa, completing the arrangement of their summer survey.

On the journey down from Sioux Lookout they were delayed by unfavorable weather. Landings were made at Sault Ste. Marie and Port Arthur.

They were met at Chats Falls by two aeroplanes flown by Col. Robt. Leckie and Captain J. A. Glen, of Air Board headquarters.

"Very uneventful," was the comment made by the pilots on their long journey. "We found it very cold, and encountered some snow."

The flight of the five machines over the city attracted many watchers. The planes landed in Ottawa River at Rockliffe, all in good order after the trip.

Catapult Launches Seaplane from Ship

Philadelphia. — A hydroaeroplane was launched successfully October 31 in tests at the Philadelphia Navy Yard off a catapulting device which sent the NC-9, two-seated craft, into the air at a speed of 43 miles an hour from a standing start.

The experiment proved, naval experts declared, that aircraft can be launched from battleships equipped with catapults on the turrets, and it is proposed so to equip every battleship.

The seaplane was piloted by Commander H. C. Richardson, U. S. N. Many high naval officers and scientists witnessed the tests.

The Larsen Trophy

Just as we go to press we learn that the Ansaldo S. V. A. took first place for the Larsen Trophy at Omaha on November 6, with a total of 4,671 points. The JL-6 was second with 4,640 points and the JL-6 third with 4,212 points.

The rules governing the contest were as follows:

Any craft was eligible, as the winning of the contest was based on the formula $\frac{(w-t)\,s}{g}$, in which (w) stands for total weight leaving ground, (t) stands for weight of plane minus gas, (s) stands for miles per hour actually made over the course, and (g) for amount of gas actually consumed.

The course in the Larsen contest was 250 miles in length from Omaha to Des Moines and return.

Development of Aviation Favored by the President

In a recent letter to the president of the *Boston Transcript*, President Harding expressed what he said was his "concern for the development of aeronautics." The letter said:

"I gladly avail myself of the opportunity to express my own concern for the development of aeronautics. It has become apparent that an amazing development must take place in the near future in the utilization of the air as a medium of transport and communication in both peace and war. In our country of magnificent distances it is peculiarly desirable that every encouragement should be given to the establishment of suitable landing fields wherever possible."

F. A. Donaldson Wins 90-Mile Plane Race

Omaha.—F. A. Donaldson of Spirit Lake, Ia., was first and C. S. Jones of New York second in one of a number of free-for-all ninety miles races for aeroplanes, held November 3.

Donaldson's time was 69 minutes and 4 seconds; Jones made the course in 69 minutes and 20 seconds; Harry Buff, Topeka, Kan., was third in 72 minutes and 35 seconds.

C. S. Jones of New York, who won the first ninety-mile free-for-all for planes with a speed of seventy-five miles an hour, received $300 prize money.

Book Review

The science of aeroplane performance calculations has become extensive, as aeronautics has been developed to an extremely high degree. The literature on the subject is meager, and the author of this book should find a reader and student in every engineer or designer who needs reliable data at hand. To give an idea of the scope of this handbook we quote the titles of a few chapters: Body Resistance, Wing Characteristics, Propeller Performance Curves, Machine Performance Curves, Air Performance and Water Performance. There is a valuable chapter on the typical machine.—*Aeroplane Performance Calculations.* By Harris Booth.

The AIRCRAFT TRADE REVIEW

Jones Wins Junior Derby

Charles S. Jones of Garden City, L. I., piloting a two-passenger plane, won the Legion Junior Derby at Kansas City over a triangular course of 87½ miles in 53 minutes and 53 seconds. A cash prize of $1,000 and a trophy cup presented by the Kansas City *Journal* formed the first prize. Twenty planes started in the race.

Second place was won by Paul D. Wilson of Ithaca, N. Y.; third, by J. W. Welborn of Tulsa, Okla.; and fourth by E. M. Laird of Wichita.

Air Service Contracts

GLOBES—Procurement Branch, Air Service, Temporary Building No. 6, Washington.—Bids are wanted until 2:30 P. M., November 7, circular ASA 9, for 2 terrestrial globes of the world.

CORRUGATED SHEATHING—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until November 8, circular 2278, for furnishing 20 gauge corrugated metal asbestos covered sheathing for roof and ends on two cantilever hangars.

GAS GENERATING PLANT—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until November 15, circular 2279, for 1 gas generating plant.

DRILL PRESS—Procurement Purchase Branch, Air Service, Temporary Building No. 6, Washington.—Bids are wanted until 3 P. M., November 16, circular AS 6, for one 24-inch upright drill press.

Commences Instruction at 42

"It's never too late to learn."

That is the motto of Alexander Schmidt, 42 years old, who is officially too old to become a unit of Uncle Sam's air service.

But Alexander Schmidt, who has been in the service of Uncle Sam for twenty-two years, being stationed most recently at Luke Field, Forts Island, Pearl Harbor, Honolulu, with the Sixth observation squadron, has an unofficial view of the question. Having spent four years in the air service, he says he is going to learn how to paddle his own air canoe or know the reason why.

After eight years in Honolulu, Schmidt has come to San Francisco on a three-months' furlough to gain instruction in flying. He came here because he is beyond the age limit when men may obtain army instruction.

The Varney Aviation Company at San Carlos has undertaken to teach Schmidt the art of flying.

An Interesting French Machine

The De Monge 5a machine which Capt. the Comte de Romanet was to have flown in the Aerial Derby is a machine which possesses a number of interesting features.

It has already, in the account of the entries for that race (THE AEROPLANE, July 13th) been described as a monoplane fitted with bracing struts running from the top of the under-carriage to about two-thirds of the half span out from the body, and this description is accurate. It is, however, also a biplane, and it was as a biplane that it would have appeared in the Derby had it not suffered a certain amount of damage caused by the collapse of one wheel when landing.

As originally designed the machine was a monoplane, and its general appearance conforms very closely indeed to Mr. Bridgman's sketch published in the aforementioned issue.

The conversion to a biplane is effected by attaching, to the bottom of the fuselage, a pair of lower wings, of small chord and of slightly less span than the upper wings, and supporting these lower wings by one pair of Vee struts—running from the front and rear spars of the upper wing—on each side.

It is said that with the added surface the speed of the machine was appreciably increased.

A curious feature is the shape of the fuselage. This is of circular section, and is entirely normal for about the front half of its length. Behind the upper wing the diameter is reduced very rapidly and in a hollow curve running into a nearly parallel tube of small diameter.

The machine is fitted with a La Tombe compressed-air self-starter, and carries a single Lamblin radiator over the center of the upper wing. Petrol tanks are apparently attached to the under surface of the top wing, at the junction of the bracing struts with that wing.

The main dimensions, etc, are as follows:—

Specifications of De Monge 5A

Span 8 metres. Length 7 metres.
Chord, top plane, 2.6 metres (center).
Chord, top plane, 1.0 metre (tips).
Chord, bottom plane, 1.0 metre.
Total wing area as monoplane, 15 sq. metres.
Total wing area as biplane, 20 sq. metres.
Engine, 300-h.p. Hispano-Suiza. Weight (full load), 900 kg.
Estimated speed (ground level) 320 km.p.h.—(*Aeroplane.*)

Air Torpedo Tested

Washington.—A successful mechanically controlled flying torpedo, destined to revolutionize land and sea warfare, has been developed for the United States Army and Navy air services. In a secret test, made two weeks ago, this remarkable aircraft, said to be the most important aerial weapon ever constructed, flew over New York City and two Eastern states. According to aerial experts here, the flying torpedo, had it been loaded, could easily have wrought great destruction to lower Manhattan.

The experiments have been carried on for several months on Chesapeake Bay, in New Jersey and Ohio in strictest secrecy, not more than 100 persons in the entire country having any knowledge of it. The machine already has made upward of a hundred flights, approximating 5,000 miles.

Its existence undoubtedly will exert a profound influence upon the Conference on the Limitation of Armament, which opens here this week, because development of the craft, according to the experts, means that coastal fortifications are rendered obsolete.

Attacking in large numbers, machines of this type would be able to annihilate cities with incendiary explosives and poison gases without the loss of one life to the attacking forces, the experts declare. In actual warfare the flying torpedoes will be guided through the air to their targets without a person on board.

During the flight over New York City the experimental flying torpedo made an unexpected landing near a small town in eastern Pennsylvania. This incident attracted little attention at the time.

Upon receiving a report of the landing of the mysterious aircraft, however, the New York *Tribune* began an investigation, and now is in a position to outline the characteristics of this remarkable machine and its possibilities. The details of construction and control are still shrouded in mystery.

The test flight on that occasion commenced from a landing ground near New York. After the engine was started the machine ran a short distance across the field, and then took the air successfully and climbed to the predetermined altitude. It then set a course due west, straight into a stiff head wind.

The most remarkable feature of the new craft is the development which causes it to take off from the starting field. The secret apparatus controlling the elevators, which govern the ascent and descent of an aeroplane, is absolutely successful, according to the experts who have watched the experiments. For straight flying across country the machine is equipped with apparatus which gives it inherent stability, causing it to right itself under all conditions.

From official sources it is learned that the flying torpedo is designed for offensive action against enemy coasts, cities or fleets. In naval warfare it will be further controlled by radio, and at no time will machines of this type fly more than twenty feet above the surface of the sea during naval engagements. It can be flown at any altitude while being used in attack against cities or coast defenses. The flying torpedoes will be filled with incendiary explosives and poison gases.

The object of flying low in naval battles is based on two important factors. First, the present indicated defense against attacking aeroplanes—besides other aircraft—is detonation set up by a barrage of anti-aircraft guns. The theory of this defense is that, while no attempt is made to obtain a direct hit, a terrific air disturbance will be set up by the exploding shells, making it practically impossible for the attacking machines to approach their objectives. This, of course, will be obviated by low flying.

The other factor is based upon the fact that when a machine is flying very low there is a back pressure of air from the ground—or sea—which tends to keep the machine in the position in which it is flying. This, with the radio control, will make the flying torpedoes almost invincible, as only a direct hit will put them out of action.

In this manner hundreds of the machines can be set to fly straight toward a fleet, and then circle around until they strike one of the battleships. Or they may be directed by an attacking fleet against enemy cities from a distance of 200 miles or more.

THE PULITZER RACE

Omaha.—Bert Acosta, veteran flyer, won the Pulitzer trophy race November 3, covering the 153½-mile course in 52 minutes, 9 1-5 seconds. This is at the rate of 176-9 miles an hour.

Weather conditions were perfect. The record for the race, 178 miles an hour, made last year, is held by Capt. C. Corliss C. Mosley of the Army Air Service, now on duty in Washington.

Lieut. Col. H. E. Hartney, Executive Secretary of the Aero Club of America, fell 1,500 feet with his plane near Loveland, Iowa, and suffered a fracture of the hip and serious internal injuries but will recover, the Omaha Hospital surgeons report. His machine was destroyed by fire originating in the cigarette of one of a hundred souvenir seekers.

Acosta's victory brings the Pulitzer trophy race to New York next year unless Acosta should have made a technical registration of his entry as from a flying club in some other city. There is no evidence that he did so. He retains the trophy cup for a year or until the annual race is won by another contestant. A cash prize of $3,000 goes to Acosta, one of the best known and most skillful aviators in the United States, a professional flyer and an expert tester of flying machines for several manufacturers, among them the Curtiss Company. He drove a Curtiss navy racer, with a 400 horsepower CD-12 motor in the race to-day.

Clarence Coombs of Houston, Tex., was second in a plane called the Cactus Kitten, his time being 54 minutes 7 3-5 seconds. Lieut. John A. Macready, in a Thomas-Morse, attached to the Army Air Service at Dayton, O., holder of the world's altitude record, was third in 57 minutes 27 3-5 seconds. Lloyd W. Bertaud of New York was fourth in a Balilla Scout. James Curran of Chicago was forced to descend and abandon the race.

The course was triangular, with Omaha and Carson, Neb., and Loveland, Iowa, across the Missouri River, for its corners, a lap of thirty miles, around which the flyers raced five times.

The day was all any speed pilot could ask. The sun shone, the atmosphere was clear with splendid visibility and a ground temperature of 48 degrees. A mild breeze too light to affect the starting, blew throughout the afternoon.

The Pulitzer Trophy race was the centre of interest and the opening event of the three-days session of the International Aero Congress here. Thousands of spectators flocked to the flying field.

The start of the race was delayed by engine trouble in Colonel Hartney's machine. Eventually the signals were given and the racers got away without Hartney, who was allowed time in which to repair his engine.

Bert Acosta in the toss-up won the privilege of starting first. He crossed the starting line at a terrific speed, estimated at more than 250 miles an hour, and was out of sight behind the hills in a moment.

Lloyd W. Bertaud of New York, in an A-1 Balilla with 400 horsepower motor, followed Acosta three minutes later. Bertaud flew high, whereas Acosta barely skimmed the line of trees on the hill.

The third man out was Clarance Coombs, driving the Curtiss Cactus Kitten, from Houston, Tex. It was painted bright red



Two views of the Curtiss Navy Racer, which Bert Acosta piloted to first place in the Pulitzer Race, establishing a world's record. It is equipped with a Curtiss C.D.12 400 H.P. Motor

and was the favorite with the crowd. When Coombs crossed the line getting the very limit of speed from his machine he was cheered by the spectators.

Before Coombs had got out of sight Acosta was back, having covered the first thirty-mile lap of the race in nine minutes forty seconds. He was off again on the second lap before the fourth and fifth men took the air.

Colonel Hartney was scheduled to follow Coombs, but because of trouble with his gasoline pump, gave place to James Curran of Chicago, in a S.V.A. Model 9, He and Capt. J. A. Macready of New York, flying a MB-6 300 horsepower plane, were sent into the race.

For the next forty-five minutes the air was full of racing aeroplanes. At times as many as three were coming down the course at the same time.

On the third lap Curran was forced down and made a perfect landing on the field. Engine trouble had developed and he was out of the race.

From the start the race was between Acosta and Coombs in the Cactus Kitten. The Kitten gained on straightaway, while Acosta made his gains on the turns.

The evenness of the race is shown by the time of the different machines; less than nine minutes separated the winner and the slowest plane in the race.

While the other machines were circling the course Colonel Hartney was endeavoring to get his plane in condition to take the air. When the last of the other entrants had completed the 150 miles and were on the ground, Hartney and his mechanicians were still working. Finally the committee in charge gave Hartney twenty minutes in which to start.

With two minutes to spare, Hartney crossed the line. He should have made the first lap in approximately ten minutes. When fifteen minutes had passed and his machine had not returned, the interest became intense.

"Where is Hartney?" was asked on all sides.

When Hartney had been overdue 20 minutes, and aeroplanes were being made ready to go in search of him, a farmer on the course telephoned in that an aeroplane had come to the ground near his home and that the pilot was injured. Assistance from the nearest relief station was rushed to Hartney, who was carried to a farmhouse and treated by a physician.

Souvenir hunters from a nearby town rushed to the scene and some one dropped a match into the wrecked aeroplane. The machine was completely burned.

Hartney explained his gasoline pump had failed to function and that when he attempted to change to his emergency supply, the switch stuck. He nose-dived to the ground.

Lieut. Col. Hartney, a lawyer, went from



Two views of the Curtiss-Cox Racer, which Clarence Coombs piloted to second place in the Pultizer Race. It is powered with a Curtiss C-12 400 H.P. motor

the United States to Saskatchewan before the World War and enlisted with the Canadian forces in 1915. He served in the trenches with the British, was assigned to the Royal Air Service and fought in the air in Italy and France. When his native land entered that struggle he joined the United States air forces, was promoted to be major and later was Lieutenant Colonel and in command of the first American pursuit group. He is an ace, and has a rec ord of destroying six enemy planes.

In last year's Pulitzer Trophy race flown at Mineola without an accident o any kind, Colonel Hartney finished second



Three views of the Ballila Scout plane which Lloyd Bertaud piloted to Fourth Place in the Pulitzer Race. It is equipped with a Curtiss C.12 motor

LANGLEY FIELD WIND TUNNEL APPARATUS

By D. L. BACON
Langley Memorial Aeronautical Laboratory

THE difficulties experienced in properly holding thin tipped or tapered aerofoils while testing on an N.P.L. type aerodynamic balance even at low air speeds, and the impossibility of holding even solid metal models, at the high speeds attainable with the National Advisory Committee's wind tunnel, necessitated the design of a balance which would hold model aerofoils of any thickness and at speeds up to 150 m.p.h.

In addition to mechanical strength and rigidity it was highly desirable that the balance readings should require a minimum amount of correction and mathematical manipulation in order to obtain the lift and drag coefficients and the center of pressure.

The general scheme of the balance herein described is similar to that which has for some years been in use at the University of Göttingen, the main difference lying in the addition of a device for reading the center of pressure directly, without the necessity of any calculation whatsoever.

A schematic diagram of the balance is shown in Fig. 1. The wing A is hung upside down from the direct reading balance B by means of four wires attached to a frame which will be described later. These four wires hang perpendicular to the air stream and thus carry the lift force on the model. In like manner wires m and n lying in a horizontal plane through the axis of the tunnel carry the drag force to the common point O where they connect with the vertical wire d and the two wires x and y lying in a transverse plane at 45° to the vertical and fastened at their lower ends to the tunnel floor. It is obvious from a resolution of the forces through o that the vertical force in d is equal to the component of M and N along the axis of the tunnel and is measured by a simple weighing beam fastened to a bench directly above the center of the tunnel.

The counterweight W is used for two purposes, viz., to prevent the wing from rising at angles of negative lift, and to maintain an initial tension in the complete wire system. It is normally carried slightly downstream by a pulley in order to produce initial drag but is allowed to hang directly downward when the center of pressure is being measured.

The details of the mechanism used for adjusting the angle of attack and for locating the center of pressure are shown in Fig. 2. The four lift wires hang from the aluminum frame ABCD which is hinged at C and D to the horizontal frame EFGH relative to which it may be angularly adjusted by a geared sector and a pinion to which is fastened an index plate at E, fitted with a spring dowel which automatically locks the frame ABCD at the exact angle desired. As the lift wires, the wing chord and this frame form a vertical parallelogram it will be seen that the chord line will always remain parallel to the frame ABCD and that the angle between AD and EH may be taken as the angle of attack. A slight error is introduced by the uneven stretching of the lift wires when loaded, but this is usually negligible.

The method used to obtain a direct reading of the center of pressure is best explained by reference to Fig. 3. The center of pressure, defined as the intersection of the resultant R and the wing chord is shown at P and the resolved forces by L and D respectively. The line of action of L intersects

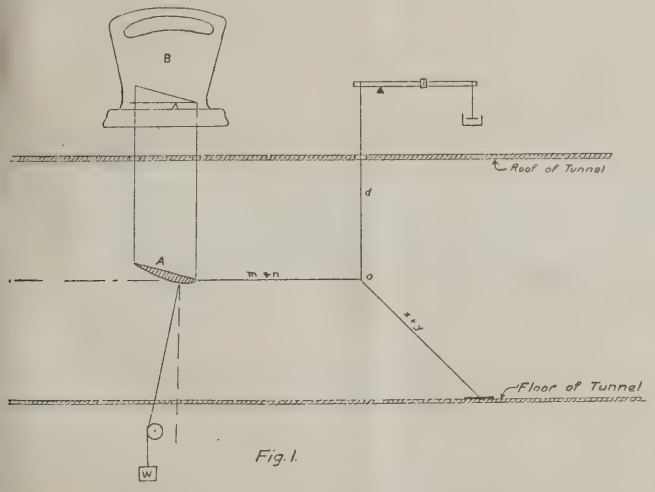


Fig. 1.

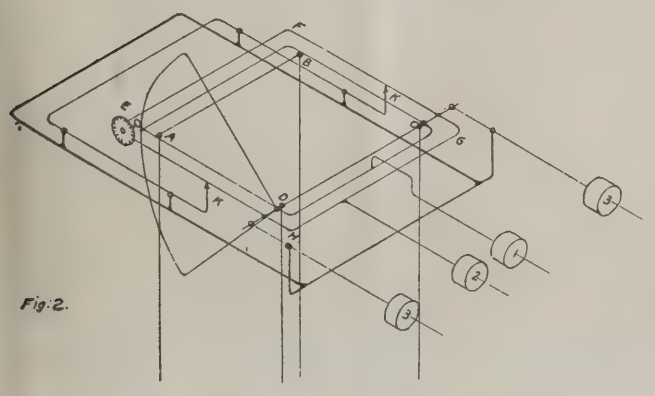


Fig. 2.

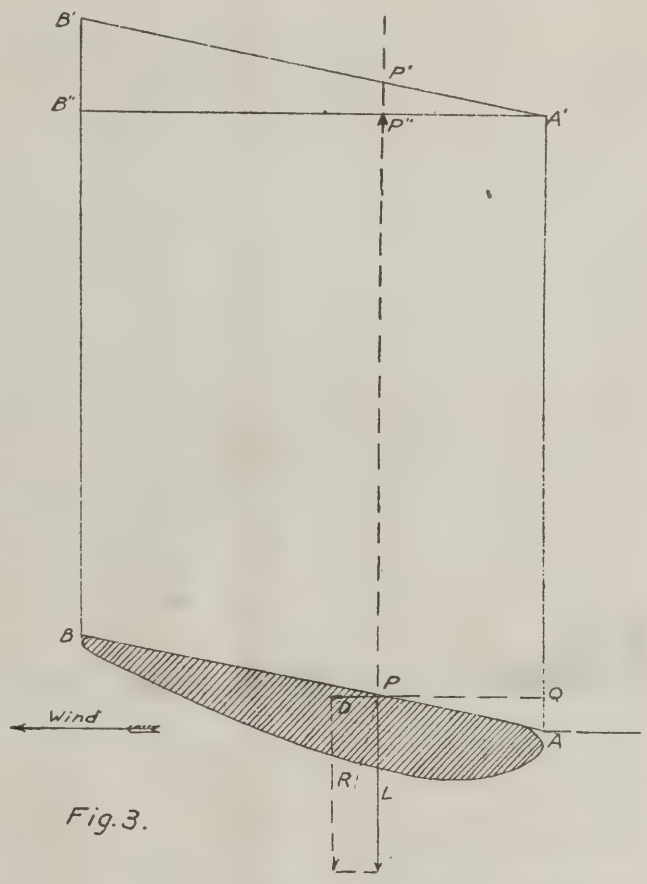
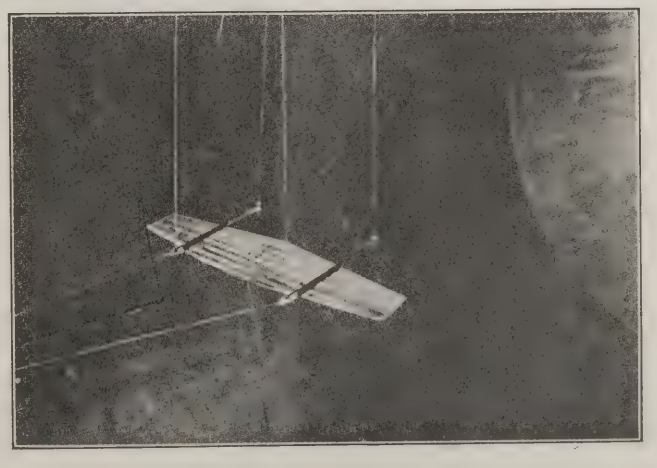


Fig. 3.


Fig. 4

an imaginary wing chord at P^1 and divides it in the same ratio as the actual wing chord. By finding a point as P^{11} where the frame EFGH may be supported in equilibrium by a pair of sliding knife edges the center of pressure of the wing may be read directly from a suitable scale. The drag force D acting at a distance QA from the line of action of the drag wire introduces an error in this reading of

$$\frac{D}{L} \tan a \times \frac{AP}{AB}$$

which for a normal wing reaches a maximum value of about 1% of the chord at an angle of attack of 16° and which may therefore be neglected In order to eliminate the effect of the centers of gravity of the various masses a series of counterweights (Fig. 2) has been provided which bring these centers of gravity to lie on the axis CD, No. 1 being connected with frame ABCD and No. 2 with EFGH. Beams No. 3-3 rest on knife edges bearing on the balance platform and support the entire moving mass in a state of neutral equilibrium when no air is passing through the tunnel. The knife edges K K slide on ways and while testing can be lifted by a cam against EFGH at any position along the imaginary chord for a trial balance. The knife edges are then moved forward or backward until equilibrium is reached. The center of pressure thus obtained is read directly in per cent of the chord with an accuracy of about 1 per cent except in the neighborhood of zero lift, when it becomes indeterminate.

The model wing is fastened by countersunk nuts to studs projecting from two steel skids attached to the wire system, as shown in Fig. 4. The zero angle is set by means of a spirit-level, and the turn-buckles in the wires.

This balance has given satisfaction in service, holding all types of wings at speeds up to 120 miles per hour, and proving convenient and labor saving during routine tests. The large drag correction for the wires prevents great accuracy of drag measurements with small models but the relative magnitude of this correction decreases as the size of the model increases.

A COMPARISON OF SPAR WEIGHTS OF TAPERED AND NON-TAPERED MONOPLANE WINGS

By R. E. ROBILLARD

Aeronautical Structural Engineer, McCook Field

WHILE the straight wing is better both for production and for ease of maintenance, the tapered wings (either tapered in elevation, plan, or both) has been frequently used for supposedly superior aerodydamic qualities and savings in structural weight.

Both claims have been challenged, and in an effort to gather some data on the question from the point of view of weight, this investigation has been carried out. While this report does not consider the aerodynamic efficiencies of the various forms, the data on weights will be of some use in comparing the various shapes in conjunction with what data there is on the aerodynamic qualities of the tapered wings.

From the results of this study it may be said that for normal aspect ratios, a thick straight wing is lighter or no heavier than the tapered wing. Admitted that the straight wing is as heavy or slightly heavier than the tapered wing, the advantages in production and maintenance easily overbalance any small increase in weight for most types of aeroplanes.

An increase in wing weight of 10 or 12 per cent has but a small effect upon the performance of an aeroplane, so that any advantage that the tapered wing could have over the straight wing must come through increased aerodynamic efficiency. Unless this gain is large, there can be no justification for the tapered wing except for very fast aeroplanes.

It should be noted that the per cent differences in weight were computed for the spars alone; the per cent differences for the total wing structure would be less, probably halved.

The original designs were based upon the USA. 27-C section, while the straight wings were based upon the Göttingen No. 387 section. Only the cantilever portions were considered.

The first study was made for the wings for the TW-5. This aeroplane was designed for two sets of wings tapered in elevation only. Below is given the data for the two wings of this aeroplane.

Data on the TW-5

	Primary Training	Advanced Training
Aerofoil	U.S.A. 27-C (constant chord)	U.S.A. 27-C (constant chord)
Span	37′ 0″	28′ 5″
Cantilever	13′ 6″	9′ 2½″
Chord	90″	90″
Aspect ratio	4.94	3.80
Gross weight	1620 lbs.	1550 lbs.
Net weight (without wings)	1300 lbs.	1300 lbs.

The straight wings were identical to the tapered wings with the exception of the change in aerofoil section. The design for both the tapered and the straight wings was carried out as follows:

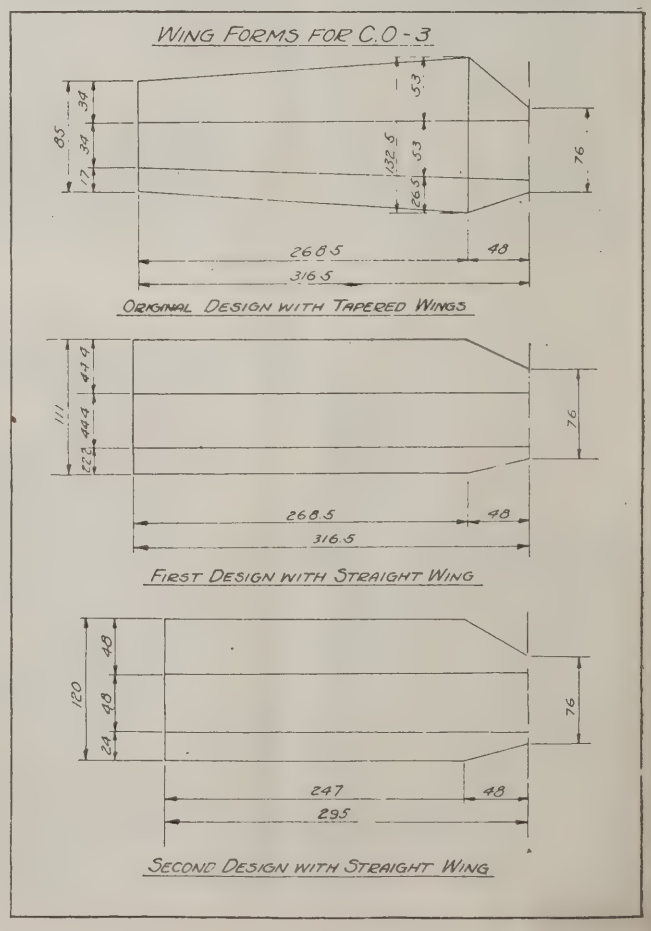
1. The tension flanges of the spars were assumed to be the same weight as the compression flanges.
2. The weight of the web members was estimated by designing a member for the average shear and multiplying its weight by the number of web members.

The results showed the straight wings to be slightly heavier than the tapered wings for the primary training aeroplane, but the reverse was true for the advanced training aeroplane in which the aspect ratio was lower. Table I gives the weights of the spar members, the total weights and the per cent differences for the tapered and the straight wings.

Table I.

TW-5

Design	Primary		Advanced	
Front: Section	U.S.A. 27-C	Göttingen No. 387	U.S.A. 27-C	Göttingen No. 387
Flanges	8.20 lbs.	8.04 lbs.	3.76 lbs.	3.64 lbs.
Web	3.78	3.44	2.54	2.37
Total	11.98	11.44	6.30	6.01
Rear:				
Flanges	7.68	9.00	3.42	2.96
Web	2.68	3.02	1.66	1.92
Total	10.36	12.02	5.08	4.88
Both spars	22.34	23.46	11.38	10.89
% of total	100%	105%	100%	96%



The second design studied was the C.O. 3, the wings of which had been designed for the USA. 27-C section, tapered both in plan and elevation. The weight estimate of these spars was made from the data given in the report on "Structural Design of Wings for C.O. 3" Serial No. 1634.

For the straight wings, two spar designs were carried out, the first using the same span and the mean chord, and a second, using a shorter span and a chord length mid-way between the mean chord and the chord at the root of the tapered wings.

Below is given the data on the wings for the C.O. 3.

	Original Design	1st Design Straight Wing	2nd Design Straight Wing
Aerofoil	U.S.A. 27-C	Gottingen No. 387	Gottingen No. 387
Span	633	633	590
Cantilever	268.5	268.5	247
Chord	132.5 (root) 85.0 (tip)	111	120
Aspect ratio	6.14	5.7	4.9
Gross weight	4900		
Net weight	4305		

The design was caried out in full detail for the front spar in each case. No design was made for the rear spar as the original design had used the same sizes for both spars.

For the first design, using the mean chord, the straight wing was heavier than the tapered wing. For the second design the straight wing was lighter than the tapered wing.

Table II is a summary of the weights of the spars for the three designs considered.

Table II.

Front Spar—C.O. 3

	Original Design	1st Design	2nd Design
	Wing.....316.5 Chord...{85 / 132.5	Wing.....316.5 Chord....111	Wing.....295 Chord....120
Upper Chord	22.2 lbs.	25.4 lbs.	17.3 lbs.
Lower Chord	15.4 lbs.	15.2 lbs.	10.4 lbs.
Web	9.2 lbs.	12.3 lbs.	10.4 lbs.
Total	46.8 lbs.	52.9 lbs.	39.5 lbs.
Web % of total	19.7%	23.1%	26.3%
Total weight % of original	100%	113%	84.2%

CARBURETION AS A PRIME FACTOR IN PRODUCING POWER

By G. M. BROWN

WHILE much has been said and written and many warnings given during the past few years, it is really doubtful if the seriousness of the fuel problem in relation to the internal combustion engine is fully realized.

While the growth of the land motor, or automobile, during the past decade has been truly phenomenal, should, during the coming decade the air motor make even a fractional growth, the combined requirements for the necessary fuel would be tremendous.

Aside from certain local conditions, the natural elements of power, the windmill and the water-wheel, are not worthy of serious consideration. The real commercial source of power lies in the evaporation of liquids.

Most prominent in these, and the only ones worthy of consideration, are water, petroleum, and ammonia.

In the mechanical and conservation use of these fluids there is a great difference. There is as much water today on the face of the globe as there ever was, in spite of the fact that light and power have been produced by its utilization.

In the large use of liquid ammonia for refrigeration, by far the major portion is reclaimed by compression after evaporation.

But with so-called gasoline once used in the motor, it is gone, never to return again, at least in any usable form.

Another difference lies in the fact that while the vapor of water and ammonia have their value strictly within themselves, gasoline owes its value to its complete mixture with air, and herein lies the true meaning of the word carburetion.

Unfortunately, this word has no real meaning today. It simply signifies a method of getting fuel, whether liquid or vapor, into a cylinder. It does not stand for an efficient mixture for correct power purposes. In other words, it does not mean evaporation and mixing.

The so-called carburetor of today is purely acknowledged as a metering device, adjustable to the amount of effective evaporation that may take place in the manifold and cylinder before combustion. The less complete the atomization, and the wetter the mixture, the harder is vaporization, and the higher the temperature required. Thus the simple natural idea of evaporation is complicated with inefficient methods which may force evaporation but do not complete mixing, sacrificing not only simplicity but volumetric efficiency.

From a chemical standpoint there is no doubt as to the consistency of an effective power charge. This is a known factor.

All fuel used beyond this amount is waste, and at the same time costly. Assuming that the cylinder temperature may finally evaporate a certain amount of liquid fuel, it seems highly improbable that within the time limit it can form a homogeneous mixture with the air already drawn in and in the function of compression.

Therefore, why not assume that the real method of efficient engine service lies in correct carburetion.

In this idea there are only two necessary factors to consider, evaporation and mixing.

A study of atmospheric laws as expounded by some of the greatest scientists on the subject will point the way.

When an idea or a device has outlived its usefulness owing to conditions, it is time to change the idea or device, not waste time on antidotes.

The present form of carburetion is a relic of the past. Based on certain natural laws, it can be brought down to requirements. Never efficient in practice, its basic principle has not been greatly changed in a dozen or more years.

As one engineer said to me in a recent letter referring to the carburetor, the reason it ever vaporized was the fault of the fuel rather than the efficiency of the instrument, and he was a carburetor engineer at that.

There are only two things to accomplish: extreme divisibility, condition for complete mixing.

While heat may help the divisibility, there are simpler means, and heat will not make an equality of mixture in chemical contents per cubic inch of cylinder charge.

A whole lot of time has been wasted in trying to correct an existing evil instead of using a little mental energy to abolish the primary evil.

In this regard it might be well to remember a few plain facts.

Evaporation takes place at all temperatures. Heat simply attempts to accomplish the results where insufficient divisibility fails, therefore it is not the superior functioning of heat as temperature, but poor preparation of the fuel toward evaporation, that leads to improper vaporizing. There are enough heat units in the necessary volume of air entering a cylinder to vaporize the amount of liquid fuel chemically required to produce a perfect mixture.

Rapid diffusion by proper mixing not only aids vaporizing, but ensures an equality of mixture both in the manifold and the various cylinders.

THE MANEUVERS OF GETTING OFF AND LANDING*

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART I.—INTRODUCTION

I. General Remarks

THE maneuvers of getting off and landing are to me the beginning and the end of flight; they separate the sheep from the goats; the aristocrat of the flying world uses them for the display of his genius, leaving his would-be imitators to find what consolation they can in the amusement with which they innocently provide the onlookers.

In commercial flying the maneuvers of getting off and landing are still the most obvious calls on the pilot's skill; and who shall deny the splendid response? But a determination to ease the pilot's task is not thereby for an instant to be excused. This, one of the most urgent problems before applied design today, lies in the conflicting requirements of ease and safety in getting off and landing and those of economy and usefulness in full flight. To assist in the statement of this problem is the object of my Paper. These are the maneuvers perhaps about which most has been said, and, from the pilot's point of view, least written. Since first a heavier-than-air machine left the ground, they have never failed as a topic of conversation throughout the whole flying community; and this has tempted me to analyze them on the basis of my own experience and that of the many pilots I have known.

Theoretical analyses of these maneuvers, while endowing the assumed pilot with human characteristics, have of necessity to envelope in a hypothetical average the diverse individual variations. Yet, in practical flying, proximity to the ground in the neighborhood of stalling point throws into stronger relief than at any other time human variations in handling. There are many classes of pilot in whose flying various degrees of intelligence and instinct are blended; and each class has its own way of meeting the difficulties and ensuring what it considers to be the maximum of safety. So it is difficult to make a sweeping generalization. At the same time, almost independently of the quickness of a get off, or the slowness of a landing, it is possible to recognize in it what is termed good or bad style, something which can or cannot be identified with cleanness of handling, reliability and a sense of mastery.

The maneuvers of getting off and landing may be divided into two classes; firstly those under normal and satisfactory conditions, with reasonably good ground and sufficient space for the pilot to get off and land without taking into account any limitations save those of his aeroplane; and secondly what are termed forced maneuvers, maneuvers in which the pilot is limited in some way; for example, getting off in a confined space, over unnaturally high obstacles or on bad ground, or, after engine failure, judging a landing in an unknown field.

A forced landing with an aeroplane on which a pilot is experienced is frequently taken as the ultimate test of his powers of foresight, judgment and flying capacity; if, then, he is not quite at home on the particular type he is flying, his difficulties in forced maneuvers will be increased tenfold. Yet the pilot has even now, due to the imperfection of the aero engine, to face the possibility of a forced maneuver on types with which he is unfamiliar before he has had the chance to become experienced on them; and so such maneuvers are worth all the study and preparation beforehand that he can possibly give.

2. The Nature of "Getting Off" and "Landing."

The maneuver of getting off will be taken to commence with the opening of the throttle when the aeroplane is at rest, and to conclude with the condition of steady climb free from the embarrassing proximity of the ground; that of landing to extend from the moment that the pilot is influenced by the necessity of approaching a definitely limited landing space, to the time when the aeroplane is again at rest on the ground.

When the pilot is about to take off the ground he realizes that his craft is not supported by the element in which he is going to fly and maneuver, but by its wheels and tail skid as it rests on the ground. From the moment he opens the throttle until his wheels leave the ground, the conditions of his support undergo a gradual translation, leading up, as it were, to the moment when he is completely air borne. During the translational period the aeroplane often shows characteristics alien to normal flight, which are apt to deceive the pilot as to what it is going to feel like in the air. Although the translation from ground to air conditions has been referred to as gradual, the process is further complicated because in practice the ground is rarely smooth enough to allow the pilot to get off without several bounces, which may disturb his well-laid plans. Neither can the pilot be said to have completed his getting off until he is climbing steadily well clear of the ground. As long as he is low down, the nearness of the ground exerts on his handling of the aeroplane a powerful influence, from which he cannot shake himself free until he is at least 1,000 ft. up. The whole process of getting off may roughly be divided into *three phases*: that in which the aeroplane is chiefly supported by the ground; that in which it is mainly air borne, but not uninfluenced by the contact of its wheels with the ground; and that in which it is wholly air borne, and the pilot is adjusting his flight to the condition of steady climb and getting clear of the ground.

Again, when the pilot flies his aeroplane towards the aerodrome to make a landing he realizes that, taking into account the angle of his glide, he must bring his aeroplane to a position close to the ground and in a condition of flight such that the translation from air to ground conditions may ensue immediately and in a kindly manner; and that, to reduce the chances of damage to a minimum and to use up the least space before coming to rest, the subsequent run, in which ground conditions prevail, will be as short as possible. In contradistinction to getting off, the process of landing may be divided into *two phases*: that in which the aeroplane is air borne and in which the pilot is adjusting his flight so as to ensure favorable conditions for approximation to and contact with the ground; and that in which the aeroplane runs along the ground before coming to rest. The modern idea of landing excludes the phase in which the aeroplane is allowed to run along the ground with the tail up. The first phase, though somewhat complex, is difficult to subdivide, for the onset of the influence of the ground is intimately bound up with the pilot's preliminary efforts to bring about conditions favorable to a good landing. Should these efforts have been ill-judged, the pilot's subsequent attempts at correction may serve rather to embarrass his landing than assist it; and what is more important, he is tempted to forget his rapidly receding powers of maneuver, and under the influence of the increasingly urgent necessity of reaching favorable conditions prior to contact with the ground, he may ask more of the aeroplane than it can give.

It is only when the pilot has yielded to this temptation that the relative frailty of the structure of an aeroplane is brought home to him; he then realizes how small a shock it need sustain to break, and how, if the maximum safe vertical drop on its wheels be small, a drop in which lateral or turning motion is included is many times smaller. Improvement of undercarriages in the properties of shock absorption and capacity to resist lateral loads may do much to mitigate errors in judgment, but it is well to emphasize how sure must be the pilot's judgment of the correct attitude of the aeroplane before contact with the ground is contemplated, when the speed at which he must necessarily be travelling and the possible unevenness of the contour of the ground is taken account of. The average pilot has to fly for some time before his sense of the translation from air to ground conditions is sufficiently vivid to make him really reliable. When he is air borne and clear of the ground in a highly controllable aeroplane, a mere bank of 20° or so is hardly differentiated in his mind from rectilinear flight, so distantly related is it to the limiting kind of maneuver which a pilot may not exceed without risk of breaking the aeroplane, and which is peculiarly confined to air handling. Not so when he is going to make contact with the ground. He is suddenly compelled to change his mental attitude towards the aeroplane; and this needs a distinct effort. Otherwise with a 20° bank on he may catch a wing-tip and turn the aeroplane on its back. A shock that the pilot hardly feels may be the prelude to a crash sufficient to "write off" the aeroplane. Many pilots, even those with considerable experience, have, after carrying out some violent "S" turns when maneuvering for position, suddenly realized that the ground is close and that the aeroplane is going to strike it; yet due to the persisting influence of air conditions have not made sufficiently drastic efforts to right the aeroplane, and so have crashed. The necessity of marshalling the aeroplane to a definite spot not only as regards position but as regards height, and, within small limits, of being at a definite speed at this spot, taken in conjunction with the sense of air freedom which the pilot has been enjoying, seems to constitute the psychological difficulty of landing well and safely.

3. Factors Which Influence "Getting Off" and "Landing"

The essential factor that influences the maneuvers of getting off and landing is the stalling speed of the aeroplane. The aeroplane must be somewhere near to the lowest speed at which

* Lecture delivered before the British Aeronautical Society.

flight can be maintained when its wheels leave the ground and when they again make contact with it. To this speed the pilot's mind subconsciously makes reference. Therefore the flying qualities of the aeroplane at and near stalling speed influence the getting off and landing very powerfully. In flight these qualities can always be felt as distinct from those at high speeds, but they vary in different types of aeroplane due to loading, stability characteristics and relative size of the aeroplane, on which three factors, assuming normally designed control surfaces, the control seems chiefly to depend. And it is with the control, which is built on these foundations, that the pilot is vitally concerned. In getting off, the relative power of the engine will also influence the flying qualities near stalling. Unfortunately, as is well known, the flying qualities near stalling make a bigger demand on the control than those in any other attitude of flight; but owing to the low air-speed, this is just what the control surfaces cannot afford. Simultaneously with maneuvering for favorable conditions, the pilot must be ready to counteract large disturbing forces. Therefore according to his skill and the qualities of his aeroplane he is compelled to leave himself a certain margin of speed in excess of stalling.

At stalling two unpleasant characteristics assert themselves; a large couple comes into play tending to put the nose down, and the aeroplane tends to become laterally highly unstable in straight flight; in other words the aeroplane at the full ebb of the pilot's controlling powers, does its utmost to bang its wheels or its wing on the ground. The pilot is naturally anxious to leave the ground as soon as he is air borne, because, even assuming there are no abnormal obstacles to surmount, he wishes to be at the maximum possible height over the edge of the aerodrome in case of engine trouble; if he allows the wheels to continue running over the ground at a speed greater than is absolutely necessary, the aeroplane is sure to be bumped about and the last phase of its get-off impaired: that is, when it reaches the edge of the aerodrome its height will have been reduced. At the same time the pilot dare not cut short prematurely the second phase of getting off while his controls are feeble and the disturbing forces large.

The foregoing remarks may be summed up by saying that the pilot always wishes, both in getting off and landing, to reduce the period in which his wheels are in contact with the ground and running over it, provided that in doing so he does not render the air-borne conditions just after or prior to contact with the ground so unfavorable as to be dangerous.

PART II.—"GETTING OFF"

1. Factors Which Particularly Influence "Getting Off"

The principal factors which influence the pilot's handling in the maneuver of getting off may be summarized thus:—

(*a*) The absolute dimensions of the aeroplane.
(*b*) The loading.
(*c*) The power of the engine or engines relative to the area and the weight.
(*d*) The position and effect of the propeller slipstream or slipstreams.
(*e*) The stability characteristics, assuming reasonable balance; and the effects of lack of balance.
(*f*) The control surfaces and their effectiveness, especially at low speeds.

Less important factors may be considered as:—

(*g*) The height, relative position and character of the undercarriage.
(*h*) The angle of the aeroplane to the ground with the tail down, and the height of the wings above the ground.
(*i*) The pilot's view of the ground, the contour of the fairing in front of him, and his position with regard to the C.G. and to the wings.

(*a*) In general, aeroplanes may be classified in size under four heads. The scout type, which includes aeroplanes of anything up to 300 sq. ft. in area; the larger single-engined two or three passenger type up to 800 sq. ft. in area; the twin-engined type up to 2,000 sq. ft. in area; and the large multi-engined aeroplane of 2,000 sq. ft. in area and upwards. The absolute dimensions give a fair measure of the liveliness of the aeroplane's motion in the air, and the magnitude of the control forces that the pilot may be called upon to exert. Small aeroplanes feel lively in the air, yet on the whole are the more readily controlled; large aeroplanes feel sluggish, but the control forces are greater and the response to the controls is slower. So for the inexperienced pilot, a medium sized aeroplane of 400 to 500 sq. ft. in area, which is reasonably handy without large control forces, presents the smallest difficulty in handling. With the smaller scouts the essence of the pilot's difficulty is that his mental response is frequently not commensurate with their inherent quickness; with twin and multi-engined aeroplanes that his physical response to opportunities of control is too feeble. And in getting an aeroplane off, as much if not more than at other times, these characteristics assert themselves. To appreciate rightly the quickness of the aeroplane's motion and the magnitude of its control forces, is the first requisite of safe maneuver close to the ground near stalling point.

(*b*) For many reasons both in war and peace the tendency to build comparatively heavily loaded aeroplanes is strong. Up to, say, 10 lbs. per sq. ft., the loading should not introduce serious difficulties. Assuming equal power, the heavier the loading, the longer is the run to get off, and the greater the demand on the pilot's skill in handling. The stalling speed is increased, and the aeroplane has to be travelling faster over the ground before leaving it, so allowing a smaller margin for the correction of errors of judgment. When the more heavily loaded aeroplane has actually left the ground with a reasonable margin of speed, it undoubtedly feels steadier than the more lightly loaded one. But once the loading rises to an unreasonable figure the control is seriously impaired; so that even under normal conditions with smooth ground and plenty of space the aeroplane becomes difficult to get off, and under severe conditions dangerous. If the loading is abnormally high, the large aeroplane is considerably worse to handle than the small one.

(*c*) The most notable, perhaps, of modern features in design is the greatly increased speed range of the aeroplane of today. This has in some measure been brought about by the increase in its aerodynamic efficiency, but more especially by the design of high power for weight aero engines. The influence of the possible speed range in getting off is of great importance. In the early aeroplanes which had barely enough power to maintain steady flight, when practically all the power the engine would give was used up in lifting the wheels clear of the ground, the acceleration was so gradual that the aeroplane ran over the ground for a long way bumping about in a degree of control that can best be described as questionable. Photographs of early aeroplanes getting off frequently show one wing dangerously dropped. Even when the aeroplane was off the ground, its height over the edge of the aerodrome was so small that the pilot was the whole time under the influence of the proximity of the ground. The saving condition of these aeroplanes was their extremely light loading. A heavily loaded under-powered aeroplane of medium size is worse; worse still is an under-powered heavily-loaded aeroplane of large size; which is what, in commercial aeroplanes, is most essentially to be avoided. The attainment in a flat calm of a definite height at a definite distance from rest with a good margin of speed and consequently of control should be rigidly insisted on, and this height and distance should be such that the pilot is quickly freed from the embarrassment of the ground; for safety, nothing ought to stand in the way of it.

Assuming that the engine were perfectly reliable and leaving out the question of economy, the relatively high-powered aeroplane, if not overloaded, is the safer in getting off. With the exception of intenser slipstream effects, the flying qualities near stalling seem to be improved; pilots sometimes describe such an aeroplane as "almost hanging on its propeller," in which saying there is some truth. With the under-powered aeroplane, the pilot is always tempted towards stalling in order to get off at all; and if partially stalled, he receives little assistance from his overburdened engine. Yet one thing to be remembered is this: if, in the high-powered aeroplane, the source of power does suddenly become extinct, the violence of the change of conditions corresponds with the power that is lost, and the pilot is left to contend with difficulties, not indeed so great as in the continual wrestling with an under-powered aeroplane when the engine is running, but greater than in the change of conditions if it fails.

(*d*) In most aeroplanes the pilot relies on the slipstream for a certain measure of longitudinal control during the first phase of getting off. That the pilot can do without, or very nearly so without its assistance is proved by the flying of some twin-engined aeroplanes. Most modern single-engined aeroplanes can be held tail down with engine full out at rest when the elevators are pulled up and the maximum negative incidence put on the adjustable tail; but there is certainly one that cannot. Nearly all twin-engined aeroplanes, on the other hand, would be pulled over on their noses by the engines under such conditions; if the tail is not held down only one engine can be run up at a time. The position of the undercarriage relative to the C.G. and to the thrust line, the angle of the tail relative to the thrust line and wing chord, and the size of the tail plane and elevators must be allowed for, but the practice in modern aeroplanes is similar enough for the above generalization to be made. It will readily be seen that if with throttle full open the tail can be held down at rest without artificial assistance, there will be no tendency for the aeroplane to tip over on to its nose in the first phase of getting off. On the other hand, if the tail cannot be held down, the pilot, before opening full out, has to be careful to allow the aeroplane to gather a little speed, by which time the wheels

will have started moving and the aerodynamic forces which enable him to exert longitudinal control will be coming into play. He will then have reached the second phase. In one or two twin-engined aeroplanes in particular, the pilot feels the tipping tendency in the first phase in a marked way.

In all single-engined aeroplanes, the slipstream, besides acting on the tailplane and elevators, acts on the fin and rudder. In twin-engined aeroplanes also the fins and rudders are seldom uninfluenced. In getting off the rudder has frequently to be moved through its maximum angle, and its value as an organ of control is impressed on the pilot by the extent of its deterioration at low speeds. Although during the second phase the rudder control is gaining in effectiveness, not only is it necessary to cope with general disturbances, but is required to counteract a disturbing force which seems to attain its zenith during the second and the early part of the third phase of getting off; namely the effect of the rotating slipstream on the fin. If the propeller rotates anti-clockwise looked at from in front, there is a lateral force on the fin tending to turn the aeroplane to port; if the propeller rotates clockwise, the aeroplane tends to be turned to starboard. A similar turning tendency is also evident in twin-engined aeroplanes with propellers of the same sense of rotation. The onset of this disturbing force tends to be if anything more rapid than the corresponding increase in power of the rudder. To cope with this force the rudden has often to be used to its full extent, and is therefore of little use for counteracting the temporary and evanescent disturbances that co-exist with it. The above contentions are based on the assumption that the turning tendency is severe; at least they show that when an aeroplane is being designed, no effort should be spared to reduce the turning tendency as much as possible.

(*e*) I have said that in getting off, an appreciation of the flying qualities near stalling is of the greatest importance to the pilot. Nothing affects these qualities more than the character of the aeroplane's longitudinal and lateral stability.

In considering the stability of the aeroplane some sort of balance has to be assumed. Laterally the aeroplane is trimmed so that it is in balance with its wings parallel to the ground, although almost inevitably it will be out of trim when getting off due to the turning tendency caused by the slipstream on the fin. Longitudinally, the average pilot may be assumed to try to arrange the balance before starting so that the aeroplane will trim at its normal climbing speed. In the longitudinally stable aeroplane, as stalling speed is approached, there will be a couple tending to put the nose down; and the more stable the aeroplane is, the larger it will become. In the longitudinally unstable aeroplane which is in trim at some normal climbing speed, the tendency is for the aeroplane to put its nose up as stalling speed is approached; and, though of course it does appear ultimately, for the nose-diving couple to be longer delayed; general flying experience seems to indicate that the aeroplane can be partially stalled without its appearance, and that when it does appear it comes into play very violently and without warning. The stable aeroplane gives the pilot plenty of warning that it is going to put its nose down when near stalling; the unstable one is amenable to a stalling moment produced by the elevators; it seems to hang for a considerable period, until it suddenly dives. The delay in the automatic dropping of the nose allows time for lateral instability to develop in a more aggravated form, and the subsequent dive is frequently the first phase of a spin.

You may sometimes hear a pilot say, "I like to trim my aeroplane nose heavy for getting off," or another say, "I like to trim my aeroplane tail heavy for getting off," the idea presumably being that they would adjust the tail during the third phase of getting off so that the aeroplane would be in balance near its normal climbing speed. At first sight this discrepancy of opinion would seem to be without logical foundation, but there may be a reason for it. May it not be the pilot's instinctive provision for the behavior of the aeroplane due to its stability characteristics? The stable aeroplane is always trying to push its nose down near stalling, so the pilot wishes to make the aeroplane heavy getting off. The unstable aeroplane at its lower speeds tends to stall itself, and the pilot tries to arrange its unstable trimming speed so that throughout the major part of the speed range it feels nose heavy. He is thus subject to the smallest control forces.

(*To be continued*)

TRIALS OF SPERRY HIGH-LIFT WINGS

The Lawrence Sperry Aircraft Company of Farmingdale, who have designed and built for the commercial market a high-lift monoplane wing, which can be fitted to standard fuselages of the JN type, thereby greatly increasing the carrying performance of machines so equipped, requested the Aero Club of America to witness the trials in which an extraordinary load of five full weighted people, with a full load of gasoline were carried.

The Aero Club was represented by Mr. George W. Furlow and three other members, who all rode in the machine, in addition to the pilot, Mr. Lawrence B. Sperry.

The weights carried as officially recorded:

3 passengers	850 lbs.
Gas and oil for 2½ hours and instruments	150 lbs.
Total	1,000 lbs.

After loading the machine as above stated, three Air Service Officers kindly consented to witness the length of run that the machine took in getting off, and after measuring this, it was found to be 300 yards against a wind of approximately 5 miles per hour.

The first test was a climbing test, and the figures recorded by the Aero Club were 2,500 feet in 15 minutes.

The next test was the length of glide, which is one of the features of this machine. The glide with a full load was measured and it was found that the machine glided a distance of one mile and a quarter, losing only 600 feet altitude.

After this the speed test was put through between the water tower at Mitchel Field, and the water tower at Westbury, a distance of 1.99 miles, and although the wind was at an angle of approximately 15 degrees to the course, which effected a loss in the average speed, 85.5 miles an hour was officially registered.

The following official comments were made by the Aero Club of America: The machine taxied very well in calm air and also very well with the wind. The mahcine does not show a tendency to nose over. It made a fine Vertical Bank. The machine handles very well when taxiing with tail skid on the ground.

The Sperry high-lift wing, as was stated before, is designed to be used on any two-place fuselage, where a better all-around performance is desired.

The wing is so constructed that it is absolutely interchangeable from one machine to another. All that is necessary in order to mount it on a fuselage is to remove the four fuselage cabane strut fittings and replace them with special fittings supplied by the manufacturer. The fittings in turn take the Fokker type of struts.

The wing is internally braced and in one piece, completely free from external bracing wires, thus permitting very easy and quick erection and dismounting. Setting up the wing is such a quick and simple operation that it is practically impossible to make mistakes; there is no truing up or other delicate adjustments, so that highly skilled riggers are unnecessary. The wing is built up with very strong deep I beams, with solid spruce web and ash cap strips. The ribs are built up with 3-ply veneer with spruce caps, leading edge is spruce. The wing is covered with linen doped and varnished. It was sand tested, standing a factor of safety of 15 before failure with a deflection of 8 inches at a factor of safety of 6.

Principal Characteristics

Span	35 ft.
Length	26 ft.
Height	9 ft.
Wing area	300 sq. ft.
Weight, empty	1,350 lbs.
Useful load	800 lbs.
Weight, loaded	2,150 lbs.
Maximum speed	85 M.P.H.
Landing speed	42 M.P.H.
Climb with pilot and 1 passenger in 10 min	7,500 ft.
Climb with pilot and 4 passengers in 10 min	1,500 ft.
Radius of action	200 miles



J. N. Fuselage Equipped with Sperry High-Lift Wing

NAVAL and MILITARY AERONAUTICS

General Patrick Visits Langley Field via Airship C-2

Major General Mason M. Patrick, Chief of Air Service, accompanied by several other Air Service officers, experienced an interesting trip in the airship C-2 on October 18th from Bolling Field to Langley Field, flying as they did under unfavorable weather conditions with dense clouds close to the ground through which it was necessary to pass.

The airship left its base station, Aberdeen, Md., at 5:30 a. m., the crew consisting of Lieutenants Max F. Moyer and R. S. Olmsted, pilots; Major R. M. Jones, observer; two engineers, a radio operator and two rigging sergeants, and accomplished much of the trip to Bolling Field before daybreak. At the commencement of the trip the clouds were very low, and landmarks could not be distinguished until a point in the vicinity of Baltimore was reached. The compass course estimated before starting was maintained throughout and brought the ship directly to Bolling Field without any deviation therefrom. During this stage of the trip a head wind of about 15 miles per hour was encountered. The landing at Bolling Field was made at 7:30 a. m., and General Patrick, Major Oscar Westover, Major J. A. Mars and Lieutenant Courtney Whitney were taken aboard. Major R. M. Jones and one rigging sergeant here left the airship.

The C-2 took the air again at 7:50—its scheduled time for leaving—and started on the trip to Langley Field. Head winds estimated at from 15 to 20 miles per hour were encountered. The ground was visible during the first portion of the journey and until a point approximately 20 miles north from where the crossing of the Potomac River occurs when traveling in an air line to Langley Field, after which dense fogs were encountered, rendering it impossible to see the ground when flying at an altitude of 600 feet. To avoid the possibility of striking hills or other objects, the airship ascended higher and maintained an altitude of from 800 to 1,000 feet for the remainder of the trip. Dense clouds were rolling along the surface of the ground, and it was not until about an hour and a half of flying through the fog that the ground was visible again, except for a brief interval when the ship crossed the Potomac River. At a point in the vicinity of the Rappahannock River the fog dissipated somewhat, and thereafter the ground was visible. During the flight through the fog the wind changed to a more easterly direction and veered the ship some 8 to 10 miles off its course.

After some difficulty upon emerging from the fog, the exact position of the ship was ascertained, and the remainder of the trip was uneventful save for the loss of about 15 minutes' time due to one of the engines cutting out on account of an oil pressure line vibrating itself loose upon the right motor, and shortly thereafter when both engines cut out due to the nonfunctioning (float valve clogged up, requiring adjustment) of the sump tank into which the main gasoline tanks of the airship drain. The practicability of carrying out minor repairs upon an airship during flight was demonstrated in these two emergencies; in the instance of the oil line Sergeant Nolan was able, after cutting out the motor involved, to crawl out upon the engine gantry and thereby reach and tighten the offending, loose, oil pressure line. The line effected was that running from the oil tank to the pump. In the instance of the gasoline feed trouble, both motors involuntarily cut out for lack of gasoline supply systems.

There is a small tank of approximately five gallons capacity located in the extreme bottom of the car below the level of all three gasoline storage tanks. Gasoline flows into this tank equipped with a float check valve, which is filled by gravity from the main tanks. In the slip stream and close to the propellers upon either side of the car are located two Robinson cup type propellers which operate a pump, forcing the gasoline from the small tank above referred to up into another relatively small tank located above the level of the carburetors and midway between the motors. This is the first instance on record of this simple and effective gasoline supply system, above described, clogging up. Hang gasoline pumps permanently installed and provided for just such emergencies were operated after it had been ascertained that the trouble lay in the non-functioning of the sump tank. In each of the two above instances when the motors cut out, the ship was found to be in almost perfect equilibrium.

At a point approaching the York River planes from Langley Field, consisting of three DH4's and one heavy bomber, met the airship, forming an escort for the remaining distance to Langley Field. The airship landed at Langley Field at 12:50 p. m.

In the afternoon, at 3:00 p. m., the airship with all passengers carried on the down trip, and in addition with Lieutenant George F. Parris aboard, took off for the return trip to Bolling Field, which was accomplished without incident, the visibility being good. A wind of about 15 miles from the southeast helped to speed up the trip very materially, and the landing at Bolling Field was made at 5:15 p. m., when General Patrick, Major Westover, Major Mars and Lieutenant Whitney disembarked, and 15 minutes later the ship took the air once more upon the last lap of the trip to Aberdeen, Md., taking on as passengers Lieutenants Wm. E. Connolly and Earle J. Carpenter. It was dusk when the ship reached the District Line, and the remainder of the trip was made in gradually increasing darkness. When passing over Edgewood Arsenal, the airship hangar at Aberdeen Proving Grounds, well provided with lights, was seen. Landing at Aberdeen was made at 6:50 p. m., without incident.

As a whole, the trip was a pronounced success, and all occupants of the ship had ample opportunity to judge the characteristics of flight in a small airship under dense foggy conditions. At one time, when it was thought likely that it would be necessary to land at Langley Field in the fog, which was then rolling directly upon the ground and of sufficient density to preclude the possibility of seeing the ground from a greater altitude than 50 feet, a radio communication was obtained from Langley Field to the effect that a ceiling of 900 feet obtained at that field. This news proved somewhat of a disappointment to the crew of the airship, as they believed it would have been very interesting to have located Langley Field at the end of a four to five hours' run in such a fog and make a successful landing. Under such conditions a captive balloon at 3,000 feet altitude would definitely have located the field, as the upper limit of the fog was not over 2,000 feet, and such a balloon could have been seen at distances in excess of 20 miles. Another very effective method would have been to arrange a smudge pot at Langley Field, throwing up a great column of hot smoke, plainly visible under average conditions to altitudes of three and four thousand feet. The Italians used this last method during the war on the Austrian front very effectively.

The C-2 is a non-rigid airship, powered by two 150 h.p. Hispano I engines. Its length is 192 feet, maximum diameter 54 feet, capacity 181,000 cubic feet, and it is capable of attaining a speed of 60 miles per hour.

With the advent of the "Roma" into active Army Air Service flying, flights similar to the above under practically any weather conditions and for greatly extended distances will be perfectly feasible. Comfort, reliability and remarkably fast time for the longer distances will be assured. Frequent runs to the Pacific Coast from Langley Field, the home of the "Roma," are perfectly practicable, and such a run as General Patrick took in the C-2 from Washington to Langley Field and return will doubtless find its magnified and improved counterpart in a not distant future run from Washington to Los Angeles and return.

While at Langley Field General Patrick and Major Westover inspected the airship "Roma," which was found to be about 73% erected and fast approaching completion. General Patrick evinced great interest throughout the trip in the meteorological conditions prevailing and in the operation of the airship and its general performance. On alighting at Bolling Field he expressed himself as well pleased with the trip.

Two Army Fliers Killed

Honolulu.—Lieut. Ulric Bouquet of Brooklyn and Staff Sergeant Vernon E. Vickers of Montgomery, Ala., were killed October 26 when their aeroplane broke into flames while they were attempting to join a flight formation at a 2,000 feet altitude. The bodies and aeroplane were badly burned.

Lieut. Bouquet was 31 years old and commanded an intelligence unit. The accident occurred at 8:36 a. m., the exact hour that Major Sheldon Wheeler was killed in a similar accident here last July, according to air service officers here.

FOREIGN NEWS

Aviation in France

It is understood that the Franco-Roumaine Air Line contemplates a regular service to Constantinople next Spring. It seems an ambitious project at present, but in five stages, with stops at Strasbourg, Prague, Budapest and Bucharest it should be quite possible and could be accomplished in 24 hours. This will be an important step in the accomplishment of the air route to the East. Moreover, the country is nearly all the way excellent for flying.

It is understood that the French firm of Farman Freres have under construction the biggest "air liner" yet produced. It is said to have a span of 58 metres and to have four engines, probably Lorraine-Dietrichs, Hispanos or Renaults. Or perhaps the report that the French are to build Napiers may have some connection with this machine. The machine is said to be destined for the Cie Grands Express Aeriens for the Paris-London service.

Swedish Aero Show

Reports from Sweden indicate that it is intended to hold an Aero Show in Goteborg, Sweden, in 1923. The time tentatively fixed for the Exhibition is July 7-31. It is stated that the Society of British Aircraft Constructors and the Chambre Sydincale des Industries Aeronautiques (France) have been approached on the subject of participation in the Exhibition and have given favorable replies. It is also hoped that Italy, Germany, Czecho-Slovakia and the United States will participate.

British Airship Policy

An order has been issued directing that the R. A. F. Airship Base at Howden, Yorks, be closed down not later than March 31st next. This order is in conformity with the policy already announced of ceasing all further activities with airships for Service purposes, owing to the necessity for the utmost economy, and making existing airships available for civil operation. The airship personnel is being transferred to other branches of the R. A. F., and a number of officers from Howden have already begun courses of instruction in order to fit themselves for new duties.

Passenger Carrying Record

Mr. O. P. Jones, a commercial pilot, must now hold the record for number of passengers carried by one pilot. Recently he passed the 10,000 mark, and it seems improbable that any other pilot has carried as many as 10,000 passengers. Mr. Jones began his work as a "joy ride" pilot in February, 1920, and his total to October 2nd was 10,100. His Avro G.EASF has carried 8,000 passengers, which must be a record for small machines. He has visited over thirty different towns all over Great Britain, and has made return visits to some. He has given exhibitions and joy rides from all conceivable sites and in all kinds of weather.

Australian Aerial Mail

The first of the series of aerial mail services in Australia under control of the Commonwealth will be inaugurated on October 30th, or, if subsequently fixed by the Minister of Defense, not later than November 30th. While a limit of £25,000 has been placed by the government on the total amount of any tender, tenderers are to be given the option in forwarding parcels to maintain a greater or less number of trips than is provided in the conditions-contract. Tenderers must name two guarantees to the amount of £5,000 for safety of mails and fulfillment of contract, and must specify the class of machines, number proposed to be provided, with their speed, radius, petrol consumption, carrying capacity, etc. The scale of charges for passengers and freight will be subject to the Minister's approval.

Mushroom Hunt by Aeroplane

Going mushroom-picking by aeroplane is the latest idea, according to the London *Evening News*.

Mr. A. S. Keep, chief pilot of the Westland Aircraft Company at Yeovil, likes mushrooms so much that when all the known places were found to be barren he decided to go aloft and "observe." He had almost "worn himself to a shadow" walking round the country. Mr. Keep started off in his machine and, flying at a height of 50 feet, suddenly saw a field with small white dots. He promptly landed and found himself in a veritable nursery of mushrooms. In a short time he had collected about 8 pounds, which he put in the cabin of the plane and flew home rejoicing.

Changes at the British Air Ministry

It is now generally known among those who are in touch with R. A. F. movements that the term of office of Air Commodore Brooke-Popham as Director of Research at the Air Ministry will shortly expire, and that he will then take up the post of Commandant at the R. A. F. Staff College, at Andover, for which he is particularly suited by his thoroughness and assiduity in whatever task he undertakes. It is understood that his successor as Director of Research will be Brigadier-General R. K. Bagnall-Wild, at present Director of Aeronautical Inspection.

General Bagnall-Wild was originally a Sapper Officer, and has therefore had a thorough technical training in his youth. After leaving the Army he was connected with the motor trade for some years, and joined the Aeronautical Inspection Department in its early days, when the late lamented Maior J. D. P. Fulton was chief of that Department. General Bagnall-Wild's interest in and capacity for research work was shown by the excellent display made by the A.I.D. under his direction at the last Aero Show. Everybody will wish him in the Department of Research the same success which he has attained in the Aeronautical Inspection Department.

General Bagnall-Wild will be succeeded by Air Commodore Halahan, now Deputy-Director of Equipment.

A Helicopter Accident

An experimental helicopter, piloted by Lieut. de Payer, collapsed at a height alleged to be 600 feet, between Puteaux and Suresnes on October 7th. The pilot was seriously injured.

Further particulars, if of interest, will be published when they are available.

The British Airship Situation

Major C. C. Turner makes the following interesting comment on the British airship situation in the London *Observer*.

For the good name of airships it is deplorable that the impression has been created that the actual cause of the break-up of the R38 is unascertainable. One must take due note of ordinary comment on this affair, and that is, that no matter how much the R38 in particular and airships in general be extolled, it is obvious that the safety factor is too small. The intending airship passenger and the commercial man who is asked to finance airships, rightly enough, from their point of view, experience a shattering of any confidence they may have felt. For if the admittedly high technical skill displayed in the design and construction of this ship failed to avert so appalling a disaster, where do they stand?

On the face of it this appears to be shrewd criticism. Nevertheless, the present writer ventures to suggest it is fallacious. The R38 was a novel type designed to possess an unprecedented combination of capabilities. Not only was she designed for war; she was designed for warfare of a particular character.

Because the coroner's court could attribute the disaster to no specific cause it must not be assumed that the Aeronautical Research Committee which is still sitting have not already learned important facts; and quite probably all these facts will not be divulged. It must be remembered that the R38 was a war airship, and in its design the United States as well as Great Britain was interested, so that secrets, whether of success or of failure, will rightly be guarded. How near she was to being a great trimuph is now perfectly well known, and this is the more remarkable for a ship built not only to surpass the great altitude capacity of the latest German airships, but at the same time to possess (although this does not appear to have been mentioned at the inquest) far greater duration and range. In the endeavor to secure these results there were important departures from Zeppelin practice: notably in dividing the gas-holder into fourteen instead of nineteen or twenty separate compartments; whereas in the smallest Zeppelins ever built there were seventeen.

It would be easy to be wise after the event. It was extremely unfortunate that during her last trial, and before she had been passed over to the Air Ministry, so many people were on board. On the other hand, during that last voyage she passed successfully through exacting tests. Nor, apparently, did the collapse occur while she was traveling at her highest air-speed, 60 knots, or 68½ miles per hour.

Whatever her previous history may have been, there appears to have been some reason for the satisfaction and confidence felt by those responsible on that unhappy day.

Many people desire and profess to believe that this disaster has put a check to airship development, and that the country is heartily sick of it. This is a suggestion of cowardice and weakness unworthy of Great Britain. If the same had ruled in the past we should have no ships, no railways, no motor-cars, to-day. So far as any bearing on the general airship proposition is concerned, the R38 disaster simply does not count.

But those who imagine it is the end of airships are sadly mistaken. The Admiralty will develop airships. It will be remembered that the Admiralty reluctantly decided to give up airships for reasons of economy, and after reference to the political situation. It was felt that for the present the big flying-boat and the deck and torpedo-plane would suffice for defence. That decision, however, was come to in the full belief that the Air Ministry would dispose of airships to a commercial concern, and that a certain amount of airship work would be carried on, including all-important training. This has not actually fallen through, and it is significant that the airship bases are still retained.

The question has, however, been given an altogether different complexion, and, in brief, the Admiralty have decided that they cannot afford to permit the complete abandonment of airship work. The Admiralty never was satisfied with the former arrangement, under which airships and crews were lent by the Air Ministry to the senior service; and will not return to it. In the course of a few months the public will learn that the Admiralty will carry on certain building and experimental airship work.

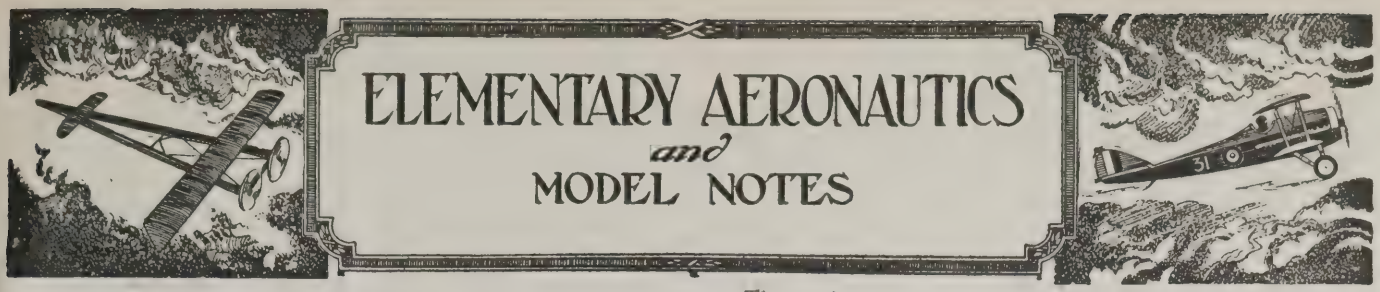
Again, it has lately been asserted that all airship research in this country is now at a standstill. This is not the case. Under the Air Estimates there is a special allocation of £7,000 for airship research at Farnborough, and valuable work is also being carried on at the National Physical Laboratory. It is, of course, very important that money so allocated shall be spent to the best advantage, and that overlapping should be avoided, for the country cannot afford to waste money. Scientific research is already being starved in all directions, and it is the more urgent, therefore, that counsels of confusion or extravagance should be resisted.

But this country will make a deplorable mistake if it consent to an abandonment of aeronautical work in any direction. Other countries are pressing ahead, and are already overtaking us in the long lead we won during the war. Germany is working hard. And every day the vital importance of air power is more clearly shown. In Mesopotamia our military control is through the air, under the command of a Vice-Marshal of the Royal Air Force. Let the nation take heed and realize that the air will be the determining element in the next war.

Brazilian Activities

The Directoria de Meteorologia e Astronomia of the Brazilian Department of Agriculture has been divided into two separate services, that of meteorology and the National Observatory. The meteorological service will continue the climatical work, established in 1919, standardizing the methods of all meteorological activities in the country and publishing all available data for the last 10 years. It will also establish a forecast service for central and southern Brazil; an aerological service for aviators and for the general progress of meteorological science creating kite and pilot balloon stations; a special coast service for navigation; agricultural and marine meteorology services; a special service of rains and floods; and the usual investigations in every department of meteorology, which may possibly lead to longer ranges in forecasting weather.

An important aerial transport company has been formed in Rio Grande do Sul for regular passenger and freight service between that city and distributing centers in the various neighboring states. The machines are of French manufacture.



The Seesock-Dayko Sport Aeroplane

LIGHT plane builders should be encouraged by the success of Frank R. Seesock and Derza Dayko, both of 722 Catherine Street, Perth Amboy, N. J., who have built an Anzani engined plane which was flown on October 9th by a professional pilot. The builders obtained the data for the design and construction from various descriptions published in Aerial Age and are high in their praise of the magazine as a medium for practical information.

The machine's dimensions are as follows:

Dimensions

Span	19 feet 2 inches
Chord	3 feet 0 inches
Gap	3 feet 0 inches
Length overall	15 feet 2 inches
Height overall	6 feet 1 inch
Weight, empty	309 pounds
Weight, loaded	552 pounds

Areas

Main wings	108 square feet
Stabilizer	12 square feet
Elevators	10.6 square feet
Ailerons	12 square feet
Fin	2 square feet
Rudder	6 square feet

Main Planes

The wings are built according to the conventional standard practice but the wing beams are solid. The rib webs are of plywood capped with spruce.

Ribs are spaced 14 inches apart, The front beams are 1⅛ inches by 3⅞ inches spruce and the rear beams are 1⅛ by 2⅞ inches.

In place of the usual internal drift and anti-drift wires, plywood is used, covering every other rib space.

Both flying and landing wires are 5/32 inch stranded cable, crossed to act as drift wires also. Incidence wires are ⅛ inch stranded cable.

Wing hinges are similar to the Curtiss "Jennie" with a 16 gauge steel strap running from one side of the body to the other and to which also are attached the flying wires.

The center section struts are of 1-inch 16-gauge steel tubing in the form of the letter H, the horizontal member being brazed to the struts near their upper ends. This form of strut does away with the necessity of incidence cables between the center section struts.

Fuselage

The body is of the usual four longeron type covered entirely with three-ply veneer. Plywood is used to bind all the corners, attached by means of glue and screws. No wires are used in the body bracing.

Longerons, of spruce, are of constant section, 1⅛ inch square.

The forward bulkhead is covered with 16-gauge aluminum which acts as a fire board, as well as a cross brace.

Controls

The stick control consists of a 1-inch 16-gauge steel tube, the lower end of which fits into a U shaped fitting welded on a cross-tube. Aileron wires are connected directly to the control stick. On the cross-tube, half horns are welded for the operation of the elevators. The lifting elevator wires go forward to a pulley behind the rudder foot-bar, thence back to the elevators. The lowering wires go direct from the stick to the elevators.

Empennage

The empennage or tail group has surfaces which are large in proportion to the size of the machine to insure effectiveness of control. The stabilizer is adjustable four degrees positive or negative so that any disturbance of the balance can be easily remedied.

Landing Gear

The V struts are of ash of a 3-inch by 1-inch section. The axle attachment is similar to the Graham-White "Bantam."

Engine and Engine Mount

An Anzani type C. 6 six-cylinder air-cooled engine is used. At 1,325 revolutions per minute this engine develops 55 horsepower. In the test runs, the engine was run as high as 1,495 r.p.m.

The propeller is 6 feet in diameter. It has a 6-foot-2-inch pitch.

The fuel tank is divided into two compartments, the front portion of which can hold two gallons of oil and the rear part thirteen gallons of gasoline. This quantity of fuel is sufficient for a flight of 2½ hours' duration.

The engine mount is the Bellanca type having two 12-inch wings of 16-gauge steel on each side of the body. Four ⅝-inch steel tube arms extend from the ends of the longerons to the rear of the engine and attach to the crankcase bolts. The engine bed is reinforced by four steel straps, crossed from the sides of the body.

Performance

The high speed of the machine was estimated by the pilot to be well over 90 miles an hour. On the trial flight the engine was not working at its best or even greater speed might have been possible. The pilot reported the balance to be very good. Other performance tests are to be made in the near future.

How E. M. Laird Built and Flew a 12 Horsepower Plane in 1913

As with many other pioneers, E. M. Laird, at the time he built his first plane, was not a pilot and had never even had a passenger ride in an aeroplane. Therefore, after building his first plane, he really taught himself to fly.

A point which impressed him and which was finally the cause of building his machine was the lack of efficiency of the aeroplanes of that day. He proceeded to apply his rather revolutionary ideas by building a plane designed not only to fly but one that would give the desired performance with one-third the horsepower used by other planes of equal size.

The plane was completed in 1913 and assembled at Cicero Field, Chicago. It was powered with a four-cylinder vertical air-cooled engine of original design. The cylinders had a bore of 3⅛ inches and a stroke of 3¾ inches. At 1,150 r.p.m. it developed 12 horsepower.

Like all other new machines of the day, its appearance naturally aroused a great deal of interest and was closely inspected by many experienced aviators and builders. It was their universal opinion (and some of these men are prominently identified with the present-day aircraft industry), that it would be impossible to even get off the ground with so little horsepower. After a few months of self-instruction in flying Laird attempted the initial flight of his new machine. To the surprise of his critics the machine did more than merely get off the ground: it made flights equal to those of machines with triple the horsepower. After seeing the machine perform, the same experts looked upon it as a revelation and hailed it as a real achievement in aeronautical development.

At that time the only possible means of income from an aeroplane was in giving exhibition flights, so with this little plane Laird travelled over five states. However, with the introduction of the loop-the-loop and stunt flying by Beachey in America and Pegoud in France, a heavier ship was demanded, so Laird then designed and built a machine that did the work with a six-cylinder 45-horsepower engine, again making a successful exhibition tour. This later machine was used the following winter by the famous woman flyer, Katherine Stinson, on her trip through the Orient, giving exhibitions in Tokio, Yokohama and other cities.

Early in 1917, Laird was called upon to act as a flying instructor and did no further construction work until the close of the war. His latest commercial ship is the Laird "Swallow" which uses a 90-horsepower Curtiss engine, designed to give the required performance on a minimum of power, thereby reducing the operating cost.



An Anzani Engined Plane built by Messrs. Seesock and Dayko from data gathered from Aerial Age



In Days Gone By

Said the bridgeroom to the gloomy-looking man: "Well, old man, have you kissed the bride?"

"Not lately," replied the g. l. m. as he passed out into the starry night.—*Wampus.*

SPIC: My fiancee insists that I obtain her a large bouquet for the dance tonight. Is it being done?

SPAN: No, you are.—*Tiger.*

Kissing, with Apologies to "Sing"

Kissing is a wicked pleasure,
I like it.
It causes grief beyond measure,
I like it.
It makes you bold, it makes you bad,
It drives you crazy, makes you mad,
It's the worst blame thing that can be had.
I like it.

Playing the Game

I hope there'll be a judgment day
So folks will understand
I played the game almighty fair—
Just made the best of my two pair,
With "three" in neighbor's hand.

I didn't try to steal the pot,
Though neighbor thinks he knows
Just how he called my "little bluff"
The time he won the precious stuff
And so of course it goes.

Perhaps when cards are dealt last round
And I and neighbor play
When waiting at the Golden Gate
I'll find a flush to beat his straight
Held pat on show-down day!

Souvenirs

"Aw git away, Kid, I'm saving my kisses!"

"If that's the case, I'd like to contribute to your collection."

—*Tar Baby.*

High Priced

THE FAIR ONE: I see here where a man married a woman for money. You wouldn't marry me for money, would you?

THE SQUARE ONE: Why, no, I wouldn't marry you for all the money in the world.—*Tar Baby.*

How About It?

It is rumored that there is a case of Haig and Haig in Brattle Square. A subscription has been started so that John the Yard Cop can take a short vacation in Africa.—*Harvard Magazine.*

CHEM.: What's all the riot in the Anatomy building?

C. E.: Oh, just the medical students rolling the bones.

—*Pelican.*

SMALL SON: Hey, pop, why do they have clocks on socks?

PROUD PARENT: So they can see how fast the seams run.

—*Lyre.*

"You say Gillis doesn't have much of a line?"

"Naw, why he can't even string a banjo."—*Froth.*

"Grabbie" voices the sentiment of the whole college when he kicks on Terry's leaving University for the news-stand of the Union. University Hall will seem empty without Terry and the ever-present cigar, and besides there isn't a chance now to have a Union charge slip lost, strayed or stolen.

—*Harvard Magazine.*

A Dante Joke

MRS. DANTE: What are you writing about now, dear?

DANTE: Oh, Hell, you wouldn't understand it.

—*Harvard Magazine.*

No Smoking

ANN: Have you stopped smoking?

VAN: Yes, I had to. A fellow can't get a good cigar on the campus any more. It is too muddy.—*Chaparral.*

"Why do you seem so fussed?"

"Oh, I always feel self-conscious in an evening gown."

"Sort of all dressed up and no place to go?"

"No. * * * Nothing on for the evening."—*Frivol.*

"I want commercial reform," screeched the speaker at the Liberal Club, "I want educational reform; I want political reform; I want—"

"Chloroform," yelled the audience.—*Harvard Magazine.*

Hypocrite

HE (*making the time-worn excuse*): I'm afraid we'll have to stop here; the engine's getting pretty warm.

FAIR COMPANION: You men are such hypocrites; you always say "the engine."—*Colgate Banter.*

Melodrama

HEROINE: What are those shrieks?

VILLAIN (*relentlessly*): They have tied an American to a chair and are showing him a bottle of Scotch.

—*Passing Show (London), from a Play.*

The rooster, like a lot of men,
Can crow to beat the deuce;
But when you crowd him for results,
You find he can't produce.—*Puppet.*

When Eve passed the luscious fruit
Then clothing came in style.
We'll have to pass the fruit again
In a short, short while.—*Sun Dodger.*

The Mail Pilot

Over the city, hill and dale,
Through the empty spaces of the sky,
The pilot wings his way with mail
On those man-made wings on high.

Seated in his wing'ed steed,
On frail linen wings is he borne
Through the air with all possible speed,
Through the wind and rain and the storm.

Planes heavy-laden with costly bales
Roar and resound through the fathomless sky,
Pilots with their precious mails
Are carried daily on high.

And so the mails continue to go
Swiftly and safely through the air,
Over the trodden earth below,
Over the slower things down there.—*Contact.*

MIRIAM: "Did you take the picture of the young man on the mantel?"

MILDRED: "Yes."

MIRIAM: "Friend of yours, I suppose?"

MILDRED: "Well, he was before I took the picture."—*The Squib.*

Aye, There's the Rub

It isn't the can that annoys the dog,
It's the fact that it's tied to his tail.
It isn't your subjects that make life hard,
It's the number of them that you fail.

It isn't the time you waste on her,
Nor the thriftless gold you spend,
But the cold and unrelenting jolt
She hands you in the end.—*Virginia Reel.*

UNIVERSITY OF ... LIBRARY
NOV 22 1921

AERIAL AGE WEEKLY

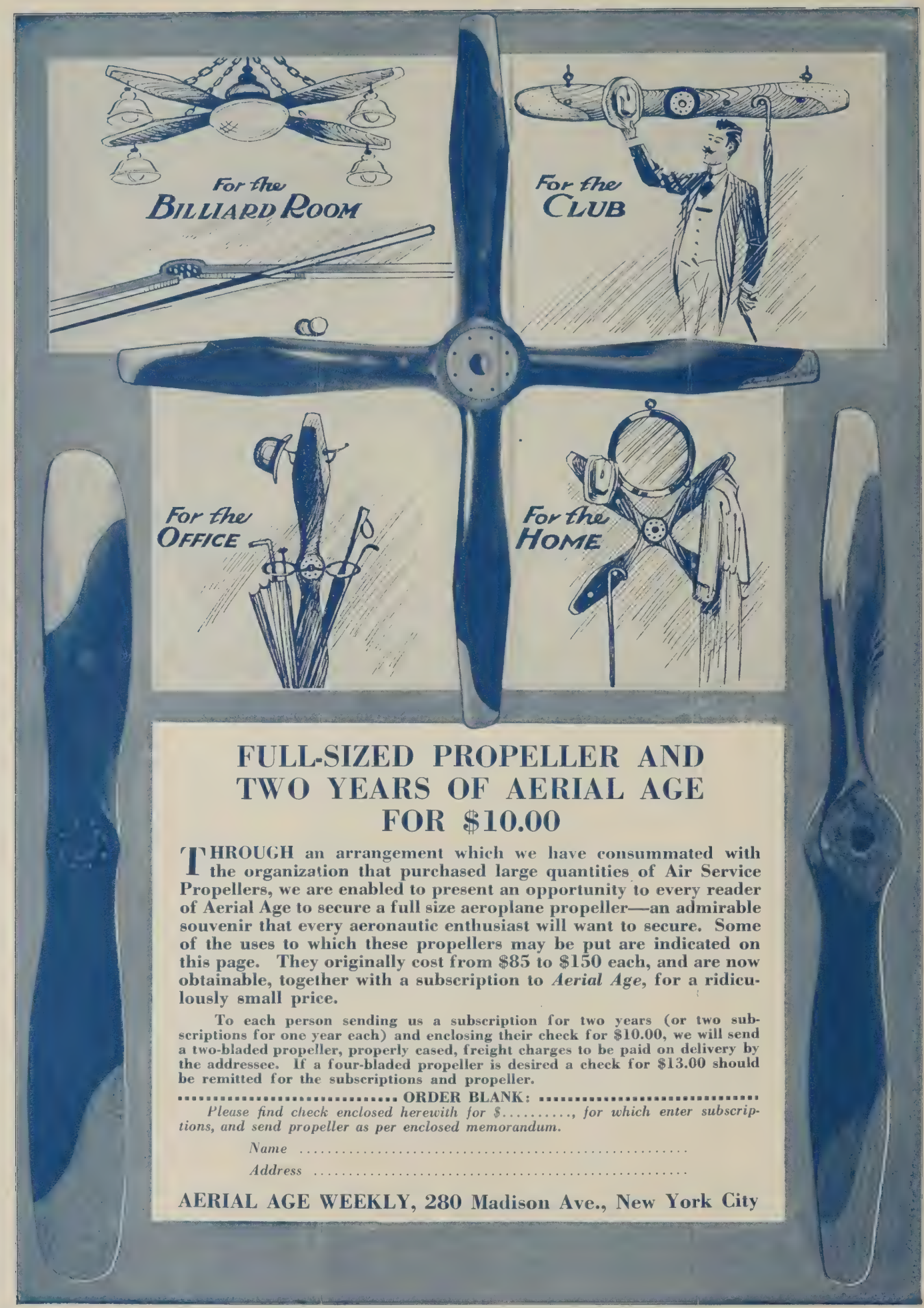
OL. 14. No. 11 NOVEMBER 21, 1921 10 CENTS A COPY



Airscape of City Hall, Philadelphia. Photo Courtesy Aero Service Corp. of Philadelphia

Fundamental Principles in Aeroplane Design

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4· Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



FULL-SIZED PROPELLER AND TWO YEARS OF AERIAL AGE FOR $10.00

THROUGH an arrangement which we have consummated with the organization that purchased large quantities of Air Service Propellers, we are enabled to present an opportunity to every reader of Aerial Age to secure a full size aeroplane propeller—an admirable souvenir that every aeronautic enthusiast will want to secure. Some of the uses to which these propellers may be put are indicated on this page. They originally cost from $85 to $150 each, and are now obtainable, together with a subscription to *Aerial Age*, for a ridiculously small price.

To each person sending us a subscription for two years (or two subscriptions for one year each) and enclosing their check for $10.00, we will send a two-bladed propeller, properly cased, freight charges to be paid on delivery by the addressee. If a four-bladed propeller is desired a check for $13.00 should be remitted for the subscriptions and propeller.

ORDER BLANK:

Please find check enclosed herewith for $....., for which enter subscriptions, and send propeller as per enclosed memorandum.

Name .....

Address .....

AERIAL AGE WEEKLY, 280 Madison Ave., New York City

November 21, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 11

TABLE OF CONTENTS

Fundamental Principles in Aeroplane Design 243
The News of the Week..... 244
The Aircraft Trade Review..... 245
The Orenco Type F-4 Five-Place Tourister 246
The Scope of Wind Tunnel Research 249
Determination of the Best Wing Loading for Single Seater Pursuit Aeroplanes 251
International Air Traffic Regulations 252
Ballooning: Its Use in Science and Sport 254
Naval and Military Aeronautics... 255
Foreign News..... 256
Elementary Aeronautics and Model Notes 257
Aeronitis 258

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

COX-KLEMIN AIRCRAFT CORP.

Consulting, Designing and Constructing Engineers

COLLEGE POINT, N. Y.

Phone, Flushing 3582-J

A REAL BARGAIN

Bethlehem Aircraft Corporation four seater airplane 100 H.P. Anzani motor. A wonderfully economical machine with the best flying qualities, perfect construction and finish. Maximum speed of 90 M.P.H., fully loaded on actual test. The only plane available of this kind. For immediate sale from our shop $4000.00

STANDARD-MERCEDES

Brand new, three place Standard with New Mercedes motor. Motor is rated at 160 H.P. and develops close to 200 H.P. Reports of pilot show perfect balance, great speed and climb. Completely equipped with instruments, and finished in every detail. Price F.O.B. factory..... $3500.00

D.H.-6 BENZ

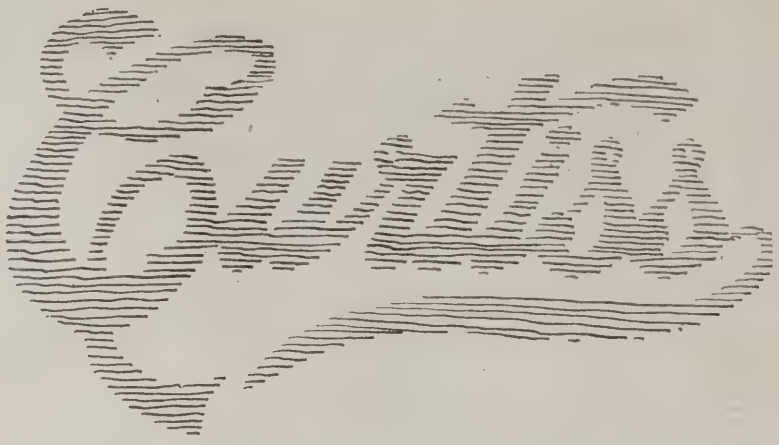
New D.H.-6 with New Benz. The Benz, six cylinder motor is rated at 120 H.P. and delivers 150 H.P. The combination makes a real two or three seater, which is in a class by itself as regards performance, general flying qualities and price. Price F.O.B. factory..... $2500.00

MOTORS

Benz, Mercedes, and Isotta-Fraschinis at reasonable prices.

COMPLETE CONSULTING SERVICE TO TRANSPORTATION COMPANIES

Write for prices and specifications. All inquiries promptly dealt with. Write in and state your requirements.



Announcing Reduction of Price List

EFFECTIVE FROM

November 1, 1921, to December 31, 1921

NEW PRODUCTION

	LIST PRICE	
'ORIOLE'		
With OX5 Motor	**$3000.00**	F.O.B. Buffalo, New York
With K-6 Motor (1919)	**4400.00**	F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	**4800.00**	F.O.B. Buffalo, New York
'SEAGULL'		
1919 K-6 Motor, dual stick control	**5200.00**	F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	**5600.00**	F.O.B. Garden City, L. I.
'STANDARD'		
With C-6 or K-6 Motor	**3600.00**	F.O.B. Garden City, L. I.
'MOTORS'		
C-6 or K-6 (150 H.P.)	**3000.00**	F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

'JN's'		
JN4D with new OX5 Motor	**$2400.00**	F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	**$1200 to 2200.00**	F.O.B. Dallas, Texas
'STANDARDS'		
With new OX5 Motor	**2000.00**	F.O.B. Houston, Texas
With overhauled OX5 Motor	**1700.00**	F.O.B. Houston, Texas
Without motor, rebuilt for OX5	**1100.00**	F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	**1600.00**	F.O.B. Garden City, L. I.
Without motor, as received from Government	**800.00**	F.O.B. Houston, Texas
'MOTORS'		
OX5 New	**800.00**	F.O.B. Various concentration fields
OX5 Overhauled	**600.00**	F.O.B. Various concentration fields
OX5 As received from Government	**500.00**	F.O.B. Various concentration fields

NOTE: Where delivery made from other than F.O.B. points accrued transportation charges must be added. Please consult our distributor or dealer or corporation direct for detailed information.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., November 21, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, NOVEMBER 21, 1921 NO. 11

Fundamental Principles in Aeroplane Design

THE purpose of the editorials appearing in AERIAL AGE which are of a technical nature is to present in a simple, direct manner certain basic principles in aeroplane design. Oftentimes this can better be done in a short technical editorial, where only the kernel can be given, than in a longer article in which the true substance is sometimes obscured by a mass of highly technical language.

The object of every aeroplane is to give a high performance. The nature of the desired performance depends upon the type of aeroplane under discussion. The Government's proposed single-seater alert type in which very high rate of climb is of paramount importance, and Fokker's F-3 in which high carrying capacity and economy of operation are essential, are contrasting types. In military types of the pursuit class, the great requirement is maneuverability. The question facing the designer is, "How may the characteristic which is most desired in any particular design be obtained to a maximum degree, and how will the other characteristics be affected?" This question must be answered quantitatively if the best results are to be obtained.

Performance depends upon five basic things: pounds per square foot, pounds per horsepower, fineness, engine-propeller factor, and wing profile. Within certain limits the designer is free to vary each of these quantities. The proper method of procedure is to hold all but one variable constant and to determine what effect different values of this variable have on the performance characteristics. Aeroplane design is always a compromise, and in securing a high degree of any one quality some sacrifice must be made. The quantitative analysis suggested shows just how far it pays to go in obtaining the desired characteristics. For instance, suppose excellent climb and ceiling characteristics are wanted, the most direct method to gain them is to increase the wing area. This, of course, adds to the weight, the span, the length and moment of inertia, and decreases the speed. Owing to the influence of fineness the change in speed is not appreciable except with large changes in wing area. Starting with a very high wing loading it will be observed that the improvement in the climb and ceiling is very great for each increment of area. But as the area becomes greater the ratio of improvement becomes less. Furthermore, most of the disadvantages are much less affected with each decrease in loading when the loading is high than when it becomes moderate. A point is finally reached when the addition of wing area causes as great a loss as a gain. Here the maximum efficiency for the design is reached. Only a quantitative study will enable an engineer to more than merely guess at the correct wing loading.

A similar procedure can be gone through with the weights. For example, one type of construction may be much cheaper but heavier than another. To determine which is the better it is necessary to calculate the performance with each weight. Or, assume that it is very desirable to increase the disposable load. The day should have long passed when anyone would say that an increase in load would not affect the performance and maneuverability. The question is, how much are these affected? With military types the addition of equipment or fuel on an existing aeroplane causes such a marked decrease in performance and maneuverability that very soon the pilot decides he would rather do without the additional armament or radius of action. This very situation has arisen within the past year in the case of our own army aeroplanes. It is unnecessary, however, to wait for flight tests. The effect of a variation in weight can be accurately foretold.

In the same way the influences of varying horsepower and fineness can be studied. By determining the effect of the first variable the selection of the right engine for the particular design can be made. A later editorial will discuss more fully this special question. As brought out in last week's column, the influence of fineness very greatly reduces the value of the Handley-Page slotted wing unless decreased landing speed is the only advantage sought. An even more practical case comes to mind. If, before the Post Office Department had decided to rebuild a number of the DH-4's, making them into a twin-engined job with two nacelles in the wing, they had known what effect this would have on the fineness the idea would have been discarded before the work was done, rather than afterwards, with a large saving of money.

The design and performance charts developed by Mr. Kerber are extremely valuable in studying these different questions. They have been published as Air Service Information Circular Vol. II, No. 183. A limited supply is available in Washington. These charts are not suited for accurate use with wing sections other than the R.A.F.15. It is hoped that before long Mr. Kerber's modification of them, allowing for the effect of any known wing profile, will be published.

These are some suggestions to improve our design work in this country. They show the necessity for a trained engineer and for lots of work on his part. The day of the designer who works by instinct or intuition has passed. Competition has made the work too complex. There is more need, however, for sound judgment than ever before to pass on the facts obtained by analysis.—B. C. B.



THE NEWS OF THE WEEK



Roma Is Ready

The Roma, America's largest airship, is now ready to make her maiden flight in this country. For several months the big ship has been under construction in the big airship hangar at Langley Field. Now she awaits the word which will open the giant doors of her berth and release her anchorage preparatory to the test flight which will later be followed by an exhibition and trial flight or cruise.

A special docking rail is being constructed leading from the landing field to the hangar. The first flight will probably be made before this feature is completed, although it will be necessary to call upon the entire personnel of the Field to handle the ship with security when this mechanical arrangement is not utilized.

The thousands who have watched with interest the construction of the airship and hope to see her in flight will appreciate the statement for which Major Thornell, who is in command of the Roma, is authority, that at least twenty-four hours' notice will be given the residents of Langley Field and vicinity of the time of the first flight of the big ship.

The crew of the Roma will consist of from twelve to fifteen enlisted men, while four or five officers in addition to the commander of the ship will be on board on all flights.

One feature of the ship is the photographic department, provision being made not only for the usual taking of aerial pictures but also for the development and printing of negatives while in flight. A complete photographic dark room is being fitted up in a roomy compartment directly under the passenger cabin.

Another interesting and practicable feature is the powerful radio equipment which is being installed which will enable persons on board to converse with ease with other aircraft or land stations many miles removed from the mighty ship of the air.

Fraud in Aerial Race Charged by Prize Donor

Omaha.—Charging fraud in the award in an air trophy race for commercial planes of which he was the donor, John Larsen of New York on Nov. 8 obtained a district court temporary injunction restraining the contest committee from paying, or E. F. White, of Fairhope, Ala., the winner, from receiving, $3,000 offered as first prize.

Load carried, speed and gasoline consumed were factors entering into results of the contest. Mr. Larsen's petition for injunction alleged that the contest committee failed to take into consideration a two-gallon emergency gravity gas tank on the wings of the winning plane, which is owned by C. B. Wrightsman of Tulsa, Okla. Had it been considered, he contended, Max Goodnough, of New York, piloting a Larsen plane, and second by the committee's award, would have taken first place.

District Judge Goss set the hearing for November 12.

High Intensity Beacon Erected at Staten Island

The Sperry Gyroscope Company high intensity vertical beacon at Tompkinsville, Staten Island, about 100 feet in from the shore and 1,000 feet eastwardly from the great Municipal Ferry Docks connecting with South Ferry, Manhattan, is now ready. The light will be vertical over this spot, gradually waving between ten and fifteen degrees each side of the vertical, making four beats a minute. The Lighthouse Commission is issuing a circular requesting observation on this beacon. Pilots of the U. S. Air Service are requested to make observation at the first opportunity and report to the Chief of Air Service as to the observation possible under the various weather conditions existing over Staten Island.

Photographing the White Mountains

One of the latest experiments conducted by the Air Service Engineering Division at McCook Field, Dayton, Ohio, is the photographic work being done with a view of presenting on a map the topography of the country photographed. The experiment was conducted in the White Mountains, and included an area 500 miles square. Information thus obtained is to be used by the U. S. Forestry Service. The expedition from McCook Field was in charge of Captain A. W. Stevens, and the equipment included a special DH4 plane equipped for photographic work, with two topographical cameras designed especially for mapping, and two Fairchild aerial cameras. The experiments occupied a period of six weeks, and practically all pictures were made at an altitude of 18,000 feet.

Sues Aviators for House Damage

Omaha.—Suit was filed here Nov. 7 against John Larsen, aeroplane manufacturer, and Col. H. E. Hartney, Washington, D. C., pilot and executive secretary of the Aero Club of America, for $2,639 damages, alleged to have resulted to the house of Charles Jesnen, Omaha, on August 3, 1920, when a plane they were flying crashed into the house.

This in one of the first cases of its kind in the courts, and the progress of the suit will be watched with interest.

Colonel R. Moizo of the Italian Delegation

Colonel Riccardo Moizo, one of the attachés to the Disarmament Conference, is one of the first Italian pilots, having obtained his license in the year 1911. He was also one of the first aviators to experiment the effectiveness of aviation in war, having taken active part in the occupation of Tripoli, and to all the campaigns of war in Libia with a squadron of Bleriot and Farman planes.

During some months of the world's war he commanded the Italian mobilized aviation forces at the front. He was seriously wounded during the passage of the Piave in the last action of Vittorio Veneto. Col. Moizo is now in command of the Training Group of the Italian Army Air Service.

Scott Field Note

The following information has been received from the Chief of the Bureau of Aeronautics, Navy Department:

Aviation activities have been discontinued at Yorktown, Va. This field will now be available only as an emergency landing field.

Gasoline, spare parts, etc., will *not* be available.

Aerial Lifeboat

A lifeboat for the air is a new contrivance being perfected in London for safety of passengers flying over water. It is an evolution of the parachute, by means of which the passengers can be released from a flying craft and dropped gracefully.

The device is so arranged that a pilot, when convinced that the chances of saving the lives of his passengers are extreme remote, simply pulls a lever, which releases the passenger compartment from the falling flying machine. The whole operation requires only four seconds. Tests have already proved satisfactory.

Aviators' Banquet

The need of better aerial preparedness was the keynote struck at the third annual aviators' dinner given Nov. 11th under the auspices of the Aero Club of America at the Commodore. More than five hundred military, naval and civilian pilots and many manufacturers were present. Among those at the speakers' table were Benedict Crowell, former Assistant Secretary of War; Eddie Rickenbacker, America's foremost ace, and Brigadier General William E. Mitchell, assistant chief of army aviation. The toastmaster was Rear Admiral W. F. Fullam, of the Naval War College.

"Aviation will be the dominating force in future war," the Admiral declared. "The overwhelming evidence of recent events forces us to conclude that sea power will hereafter be dependent upon air power. It must be perfectly evident that the transportation of large bodies of troops overseas in defenseless transports will be absolutely impossible if the enemy is supplied with an adequate air force. It simply cannot be done, no matter how powerful the accompanying force of destroyers may be.

"The danger to the fleet from aeroplane bombing has been discounted by naval officers until recently. But now we know that the most dangerous enemy of the enormous $20,000,000 vessels which now constitute the fighting line of the navy will soon be the aeroplane. By using bombs, torpedos, mines and poison gas, heavier-than-air machines can subject a fleet to conditions under which ships cannot exist."

General Mitchell took up the value of the aeroplane from the military point of view, declaring that the War Department had figures on just how much explosive and gas would be needed to destroy New York.

"Those figures show that a single squadron of twenty-five planes could wipe out the city in five minutes," he asserted. "After that what would be left of the United States? Her whole economic system would be crippled.

"Furthermore, for the cost of one destroyer, $2,500,000, we could build enough planes to wipe out any hostile fleet that could possibly be sent against us."

In order to bring American aviation up to the proper standard General Mitchell urged the unification of the War and Navy departments, with three bureaus, one for military, one for naval and one for aeronautical affairs.

Eddie Rickenbacker presented the need of keeping the air force personnel ready for an emergency. F. H. La Guardia, President of the Board of Aldermen, spoke of the possibility of going back to Congress to support aviation bills.

The AIRCRAFT TRADE REVIEW

Europe's Air Lines Fast Increasing

Washington.—Commercial aviation is rapidly forging to the front in Europe as the chief method of fast passenger and light freight traffic. Reports to the Department of Commerce show that the number of passengers and the quantity of exports and imports transported by aeroplane are increasing by leaps and bounds, especially between England and the Continent.

The average monthly value of British imports by aircraft from October, 1920, to April, 1921, amounted to about £50,000 (normally about $250,000). Exports averaged an equivalent of $140,000. Re-export values were about $135,000 a month.

Rates on parcel post shipments by aeroplane from London to Paris were reduced in August to 6 cents a pound, and parcels will be delivered to the house addressee upon payment of a small extra charge. Thus parcels are delivered in Paris on the day they are mailed in London. Nearly 200,000 letters were carried in the last nineteen months.

The London-Paris freight charge is 1 shilling a pound for packages up to 100 pounds and 10 pence a pound for packages weighing over 100 pounds.

A passenger aeroplane service has just been put in operation between Riga and Reval. Fokker monoplanes with accommodation for four passengers are used. The planes leave twice a week and connect with the aeroplane service from Riga to Danzig and from Danzig to Berlin. The trip from Reval to Riga is made in two hours and the fare is 6,000 marks, or about $15 at the present rate of exchange.

There are in Europe now twenty air lines, covering a total distance of 6,000 miles. France holds first place with lines covering 2,900 miles. Germany is second with 2,000 miles and England is third. There are many local lines also, Italy leading with 1,260 miles.

The French are anxious to establish a line between Paris and Constantinople and one between Paris and Toulouse, the latter to form part of an international line 1,800 miles long.

New London Seaplane Station

The following information has been received from the president of the Aero Transportation Company of New London, Connecticut:

The Thames River at the city of New London affords good facilities for seaplanes. The locality may be recognized by the two large parallel steel bridges extending across the river from New London on the western bank to Groton on the eastern bank. The river is large enough to allow of take-off in any direction. There is a tidal range of about 4 feet with plenty of depth. The eastern bank of the river consists mostly of ledge rock; the western bank is sand with excellent beaches for landing and for repairs.

Gasoline, oils, supplies, and moorings can be found in Greens Harbor, on the western bank of the river below New London, southward of an old stone fortification, northward of a large marine wrecking company's yard and westward of an island piled up with driftwood. There is a gasoline pump at the end of the dock and excellent beaches and reasonable service can be had here.

Facilities for hauling out can be had at the Ship & Engine Co.'s plant on the eastern side of the river. Repairs to hulls of boats can be made by the Sea Sled Company, of Mystic, or by the Aero Transportation Company of New London. The latter company keeps Liberty Motor parts and does general motor and plane repairs.

Subsidies for Aviation By European Governments

France and Belgium grant varying sums towards payment of pilots, cost of gas and oil, etc. Germany gives a premium on the number of kilometers flown. England pays a subsidy which, for 1922, is placed at £200,000, which subsidy, it is stated, is for services from London to Paris, to Brussels and also to Amsterdam, the British competing with a Dutch company for the service between Amsterdam and London.

Speedy Monoplanes

The Nieuport Monoplane was a plane to conjure with in the early days, and its reputation for speed has outlived that of many of its pioneer rivals. The latest model (Nieuport-Delage) just put up a new record, being flown at 206 miles per hour with a 300 h.p. Hispano-Suiza motor. This new model must, however, still be called a biplane, but the lower plane is so small as to be quite insignificant. It consists of a very reduced surface, one metre square, affixed between the two landing wheels. The upper plane has a span of 8 metres and a breadth of 1 metre and 50 c., the fuselage measures 6 metres, 50 c., and the whole machine when ready for flight weighs 950 kilogrammes.

The latest type of monoplane in England, the Handalula, is a radical departure from current practice, the wing being shaped like that of a bird. This machine, which is now simply called "Alula," was flown by Commander Kenworthy at Northolt Airdrome and attained a speed of 187 miles an hour. It reached a height of 3,000 feet on almost its first flight. This remarkable performance was carried out with only a 300 h.p. Hispano-Suiza engine, but with a larger machine of modified design and engined by a 1,000 h.p. Napier "Cub," a much greater rate of speed is expected. The Alula wing is a specially high lift wing, said to be very efficient and designed by Mr. Holle, who has been studying bird flight and the subject of high lift wings for 20 years. A London paper, touching on the remarkable speed performances of the above planes, states: "Now that the problem of using larger engines in monoplanes is well nigh solved by mounting them in a fuselage below the wings instead of on top, we may expect that the speed and climbing records will fall like a shower of stars for a while, after which there will be a pause to consider how the designs can be transformed into a little more aeroplane and less engine."

Reliability of Aero Engines

The London *Financial News*, commenting upon the astounding mileage achieved by aeroplanes making daily flights between London and Paris, states that the most successful machines operating between these two cities have been the DH-18's which, fitted with a single 450 h.p. Napier aero engine, have a passenger carrying capacity of eight and a total loading capacity of 18,000 lbs. These Napier engines run the remarkable distance of 10,000 miles before they are taken down for examination, not because it is necessary but purely as a precautionary measure as a careful car owner will have his engine taken down after a similar mileage. After examination these engines are reassembled and put into service again. Some of the Napier engines on the London to Paris aero mail have actually covered a distance of 25,000 miles and are still making the daily journey.

Camp Dix Landing Facilities

The following information concerning Camp Dix has been received from Captain F. P. Mulcahy, U. S. M. C., under date of October 19, 1921:

Camp Dix is located about three-fourths mile south of the small town of Wrightstown, in Burlington County, N. J. The landing field is eastward of Camp Dix and southeastward of the hospital and the power plant, which has six very tall smokestacks. The landing field is 300 feet above sea level; 1,500 feet by 300 feet, long axis east and west; prevailing wind, west. The field is smooth; a few dead furrows run lengthwise but do not bother a plane in landing. The field is also fair under various weather conditions. There is a low fence at the eastern end of the field; the west is open and clear but very narrow. There are trees along the whole north side, while the south side is open, but landings must be made not more than 100 yards from the north edge, as a road extends across the middle of the field, north to south, and a ditch parallels this road southward from a point 100 yards from the north edge. The field can be approached from the south, but approach from the east or west is preferable.

There are no repair shops, but gasoline, oil, and fresh water are available. There are no aviation supplies. The field is available for use by anyone.

Loening to Build New Factory

Albert B. Ashforth, Inc., leased for the estate of H. D. Brookman a plot, 129.9x 98.9, on the south side of Thirty-first Street, 225 feet east of First Avenue, to the Loening Aeronautical Corporation, manufacturers of the Loening flying boat. They have contracted for the erection of a building especially designed for the manufacture of flying boats and aeroplanes.

THE ORENCO TYPE F-4 FIVE-PLACE TOURISTER

THE type F-4 is the second of the commercial types developed by the Ordnance Engineering Corporation. Data gained from the F type produced last year, and which proved so successful as a passenger carrier, made possible an improved model embodying features which overcome the doubts of the most particular. For example, there is the side door to the front cockpit where three passengers can be accommodated. Easy access has thus been achieved with no diminishing of the structural safety, for a neat quick-locking catch on the door unites the longerons and their strength is unimpaired.

Mahogany veneer sides and bottom, triple sets of longerons and diagonal spruce bracing form the body and give it rigidity as well as fineness of contour. The finish reminds one of the Orenco type D military pursuit fighter, one of the most successful of single seaters and most attractive in appearance.

Dual controls in the rear cockpit enable a pilot to allow his passenger to handle the plane at safe altitudes. As the pilot can observe the way in which the controls are handled he can quickly correct improper manœuvres by an inexperienced passenger. This seating arrangement has proven to be the best for professional instruction, as the pupil and instructor can make themselves understood easily. The closeness of the pilot also gives a pupil confidence, one of the essential attributes of a successful air pupil.

The front cockpit is roomy and comfortable. There are no controls there. A locker is provided for light baggage. As the illustrations show, there are no incidence cables to obstruct the cockpit. Vision forward and downward are excellent.

Principal dimensions and specifications are as follows:

Dimensions

Span, both wings	39 ft. 0 in.
Chord	5 ft. 0 in.
Gap	5 ft. 3 in.
Stagger	14.5 in.
Length overall	21 ft. 10 in.
Height overall (at center section)	9 ft. 4 in.
Distance from ground to c. l. of propeller	5 ft. 3 in
Clearance between propeller and ground	11 in.
Propeller diameter	8 ft. 8 in.

Areas

	Square feet
Main planes (4) each 76 sq. ft.	304
Center section	14.4
Ailerons (4) each 10 sq. ft.	40
Total supporting area	358.4
F in 4.7, Rudder 11.8	16.5
Elevators 23.1, Stabilizer 27.7	50.8

Weights

	Pounds
Total weight with full load	2,825
Total useful load	978
Net weight	1847
Weight per horsepower	15.7
Weight per square foot of surface	7.3

Performance

Maximum speed at ground	110 m.p.h.
Cruising speed	99 m.p.h.
Landing speed	49 m.p.h.
Duration of flight, 5 people (cruising speed)	2.4 hours
Duration of flight, 4 people (cruising speed)	4.2 hours
Duration of flight (3 people (cruising speed)	6 hours
Climb to 10,000 ft., full load	23 minutes

Main Planes

The R. A. F. No. 15 wing curve is used. Both wings are set at an incidence of 2 degrees.

Ribs in the slip stream are spaced 9 inches apart; beyond this the spacing is 12 inches. Internal struts and wires are used for drift bracing.

The center section contains a gravity tank which holds 32 gallons of gasoline. Center section 44 3/16″ wide.

Fuselage

Veneer of 3/32″ three-ply mahogany covers the sides of the body from the radiator to the rear of the pilots' cockpit. Veneer on bottom from front landing strut to rear of cockpit. Veneer sides and bottom below the stabilizer.

The maximum width of body, at front cockpit, is 44 3/16″ outside. This provides ample room for three occupants.

Three longerons are used on each side. The top longeron is hinged at the left of the front cockpit and a veneer door swings outward. A streamline knob at the top locks the door, and being capped with channel steel, the longeron is as strong as though continuous.

Empennage

A high aspect ratio stabilizer is used, shown by experience to be desirable. The elevators are balanced so as to relieve the pilot of strain. The stabilizer is adjustable within small limits, though no alteration was found necessary by the test flights.

The fin and rudder are conventional and quite effectvie. One pair of cables from the pilots' foot-bar operates the rudder. The two rudder bars in the cockpit are interconnected by levers and a horizontal bar in front of the rudder bar.

Landing Gear

Wheels and axle are of the De H. type; their ruggedness makes them ideal for cross-country trips, and in case of breakage they are readily replaced at most flying fields. The chassis V's are of laminated spruce.

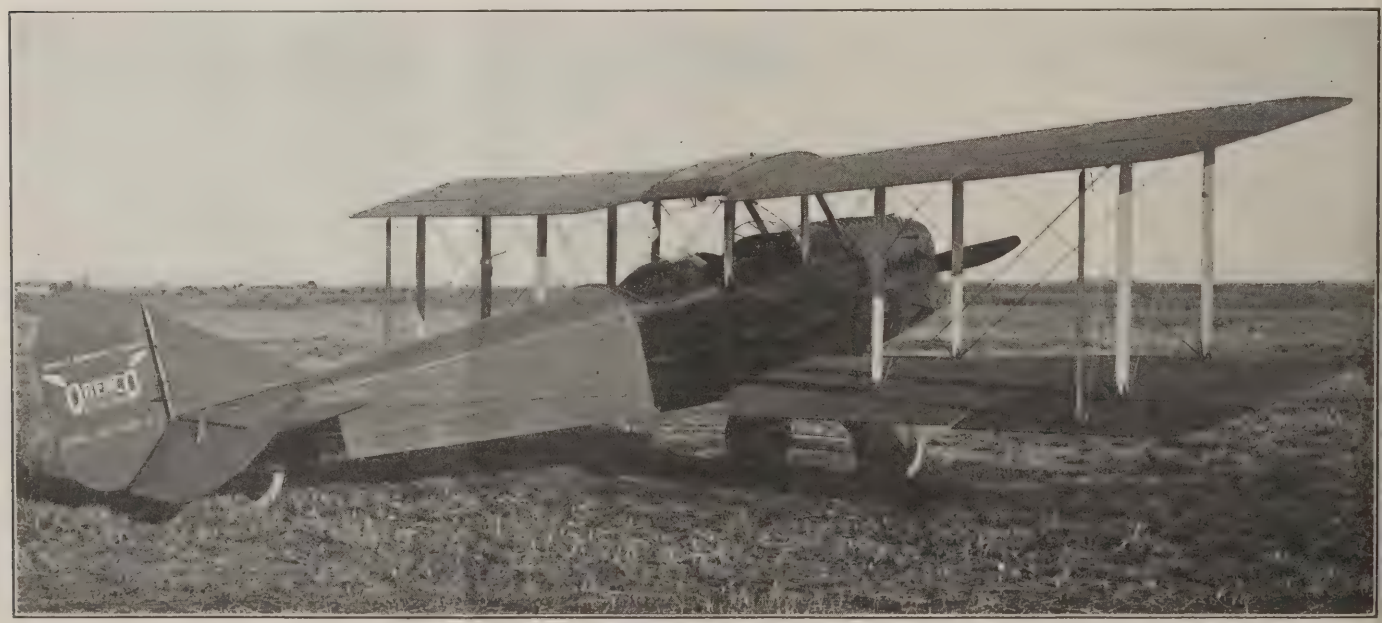
The tail skid is of special "Orenco" design, developed from previously tested types.

Engine Group

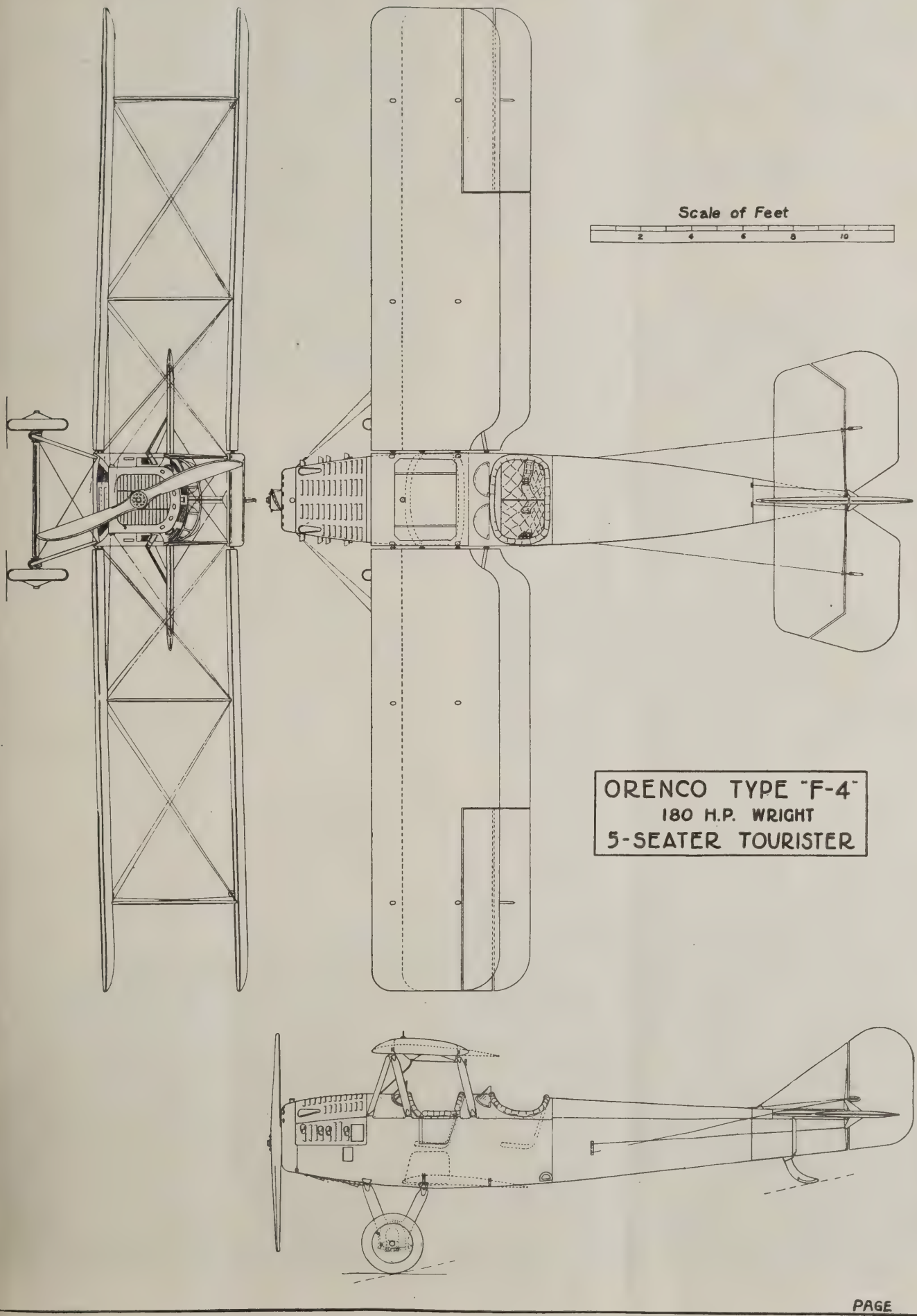
The latest model Wright E-2 engine is used. This new engine develops 200 h.p. at 1800 r.p.m., and 220 h.p. at 2000 r.p.m., but its average number of revolutions in the F-4 is 1600, at which rate the power is 180 h.p. The engine weighs 485 lbs. dry with hub. Gasoline consumed per h.p. hour, .48 lbs.

The propeller was especially designed for the F-4 by the Hartzell Walnut Propeller Co. It is unusually efficient and gives a maximum of thrust for the power available. In combination with the Wright engine, the power unit is considered the most reliable known for this purpose.

A hand-starting magneto facilitates starting. A hand-primer



The Orenco Type F-4 Tourister


Scale of Feet
2
4
6
8
10
ORENCO TYPE "F-4"
180 H.P. WRIGHT
5-SEATER TOURISTER
PAGE

is located on the instrument board. Sperry instruments are used. The instrument board includes the following: Turn-indicator, tachometer, air and oil pressure gauges, air speed meter, altimeter, moto-meter, clock and compass. The engine throttle is in the center of the dashboard, where it can be operated from either right or left rear seats. A hand pump below the seat is easily reached.

The main fuel tank, holding 48 gallons, is directly below the front seat. From this tank the fuel is pumped (by the engine or by hand pump) to the large gravity tank in the center section. From the gravity tank the gas flows to the carbureto in a direct line so as to minimize the risk of obstructions i the line. A float-type capacity gage shows the pilot the amoun of fuel in the gravity tank. A shut-off valve under this tan has an extension handle within the pilot's reach.

The radiator is made of standard hexagon copper tubes 4 long. Area of radiator surface, 176 square feet. Frontal are of radiator, 668 square inches. Shutters, controlled from th pilot's cockpit, are put into operation to reduce the coolin effect at altitudes and ordinary cold weather temperatures.

THE SCOPE OF WIND TUNNEL RESEARCH

With a Special Word to the Technical Schools

By E. N. FALES and F. W. CALDWELL

PART I

Extenson of Aeronautical Research: In the development of areonautics to date, there is an element,—the Wind Tunnel,—which has proved itself essential, and to which we are now according, in the United States, a gratifying though tardy recognition. It is a fact that those nations who have attained leadership in aeronautics are the ones who have best exploited the aerodynamic laboratory. Thus, if we survey the past eighteen years, we see that the United States invented the aeroplane, aided by the Wind Tunnel of the Wright Brothers. France soon took the lead in early development,—and it was there the first large commercial tunnel was established by Eiffel. England then captured France's lead; her Government established several wind tunnels, appointed competent personnel to handle scientific research, and deliberately built up her technical sub-structure until in the world war she obtained air supremacy both in a military and scientific sense.

As for Germany, it transpires that all her aeronautic achievement at the fighting front had its scientific counterpart behind the lines, where the Junkers Wind Tunnel, the Zeppelin Wind Tunnel, Dr. Prandtl's Wind Tunnel, etc., produced the noteworthy results which are now common knowledge. Italy has done little wind tunnel work and we hear correspondingly little of Italian progress. The United States has but a few wind tunnels,—far less than Europe,—with the result that, deficient in research facilities, we have to import our design data from Great Britain, France, and Germany.

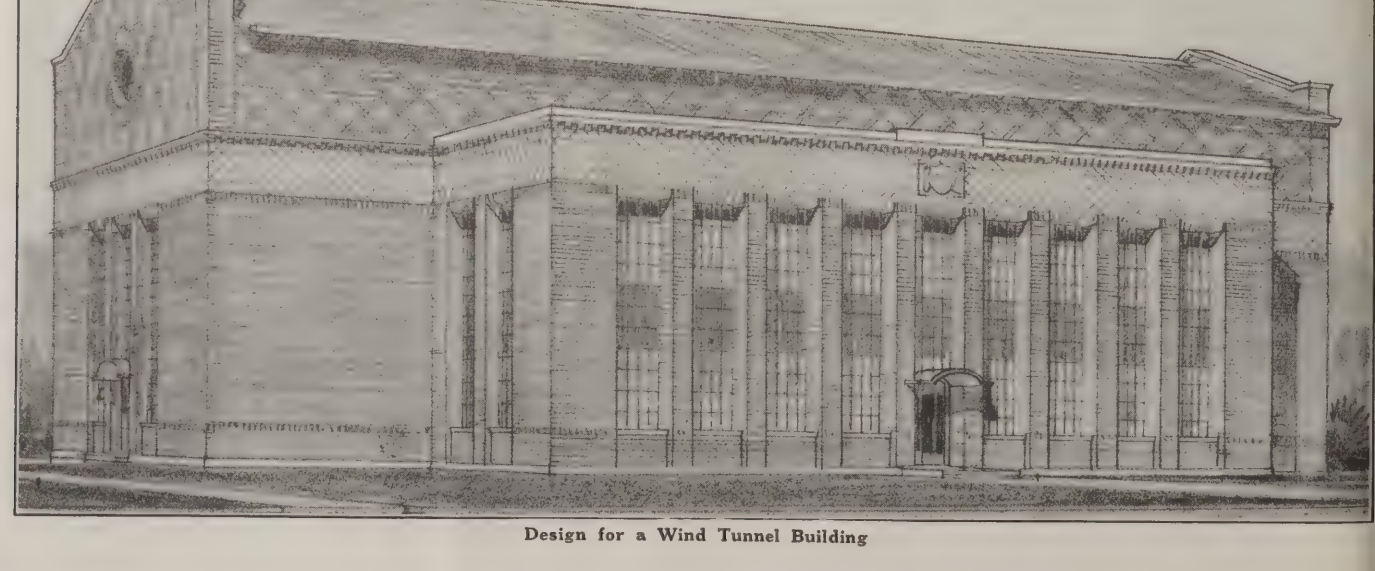
In order to remedy the situation educational development is needed, such as must come in the colleges. It is the purpose of this article to emphasize the coming expansion of aerodynamic knowledge, which is reaching a growth more and more attractive to laboratory investigation. Since this knowledge is extending its influence not only in the realm of manflight, but also in the older branches of engineering like ventilation and surveying, it ought preeminently to be subsidized by the technical schools.

In presenting this viewpoint to the college authorities, it is desirable to summarize yet again the imminent importance of aeronautics. For, even after the development of recent years we are confronted with skepticism, which dies hard, and which it is the business of the colleges to illumine. Of course thoughtful persons acknowledge that this science will in time play an important part in the daily affairs of humanity; but they hesitate to conclude that manflight will become a factor to the present generation. For this they cannot be blamed,—even in aeronautical circles the calling is viewed as offering an uncertain livelihood. But while the Aeronautical Engineer comprehends intimately the hazardous side, he senses with equal intimacy the future importance of the field in which he is a pioneer. The colleges, as educators, are responsible to the future generations, and careful scrutiny of the swift progress already made will result in an optimistic appraisement.

Imminent Importance of Aeronautics: Compare the art in 1914 with the art today,—and observe that whereas in 1914 there was a small precarious aeronautical business, there is today more than tenfold the capital involved; whereas in 1914 the number of craft in daily flight was a matter of dozens, today it is hundreds; whereas in 1914 the personnel engaged was a matter of dozens, today it is thousands; whereas in 1914 there were two wind tunnels in the United States, today these are multiplied sevenfold. Whereas, in 1914, there were but a few Universities concerned over their duties to aeronautics, today there are dozens.

The more conservative organizations, which in 1914 did not care to notice aeronautics, today are courting her open-armed. The A. S. M. E. has established an aeronautical section; the S. A. E. has given one-half of its scope to aeronautics, and altered its name to suit; municipalities are setting aside landing fields, establishing air boards, air police, and vying with one another for first place as air ports.

We see the air mail firmly established as a daily routine; the forest fire-patrol service greatly simplified by air craft; the



Design for a Wind Tunnel Building



Air flow as visualized in Wind Tunnel

Navy with its dreadnoughts threatened by the new swift destroyer of the air; the U. S. Geological Survey provided, through aerial photography, with an important aid to their map-making. We see air passenger routes profitably operating; and landing fields established throughout the country.

The Wind Tunnel the Starting Point of Technical Aeronautics: What part has the Wind Tunnel played in this development? The answer is a category full of detail. The Wind Tunnel enabled the Wrights to perfect their original aeroplane and to predict its performance before it flew. It enabled Nieuport to design the first high speed aeroplane which subsequently won the Gordon-Bennett Cup Race, furnishing him the necessary data in the Champ de Mars Laboratory even prior to flight test. It enabled Junkers to develop his thick wing aeroplane. It enabled the British to inaugurate a new era of aeroplane stability. It may be thanked for the new high lift wings, for without it Handley Page, Jacobs, and others could not have developed these interesting improvements.

It has enabled aircraft designers to obtain advance data on proposed novel designs, so that for two per cent of the estimated cost, success or failure is predicted. (The figure 2% represents the cost of scale model and laboratory tests, as a fraction of total cost of full size machine.) Where the wind tunnel has been unavailable, cases are on record in which large sums of money were therefore wasted,—sufficient in amount to buy up every wind tunnel in the country. For the well planned wind tunnel test is equivalent to the civil engineer's "preliminary survey"; upon it he bases all his future work. It has been the "watchdog of efficiency" during ten years of innumerable routine studies on models of wings, complete aeroplanes, radiators, air bombs, dirigibles, instruments, etc., during which time our fund of aeronautical knowledge has vastly increased and our methods of aeronautical research improved. Indeed in the Wind Tunnel, the intricate motion of the air itself has been made visible, so that for the first time in the history of mankind can the "way of the winds" be observed with the naked eye.

Research Work Necessary in Every Industry Today: It is seen from this category of accomplishments that aeronautics has in the wind tunnel just such a research laboratory as is essential to the electrical, chemical, etc., industries, and we can better appreciate the part it has to play if we look at it in this light. We hear a good deal nowadays on the subject of the research department. It is a product of the past few decades, when industrial organizations have found that they cannot by any other means keep pace with rapidly improving technical processes. While the factory and the sales office have been the two main departments of the typical American industrial organization, the changing times find them unable to handle their business without a further new department;—the Research Department.

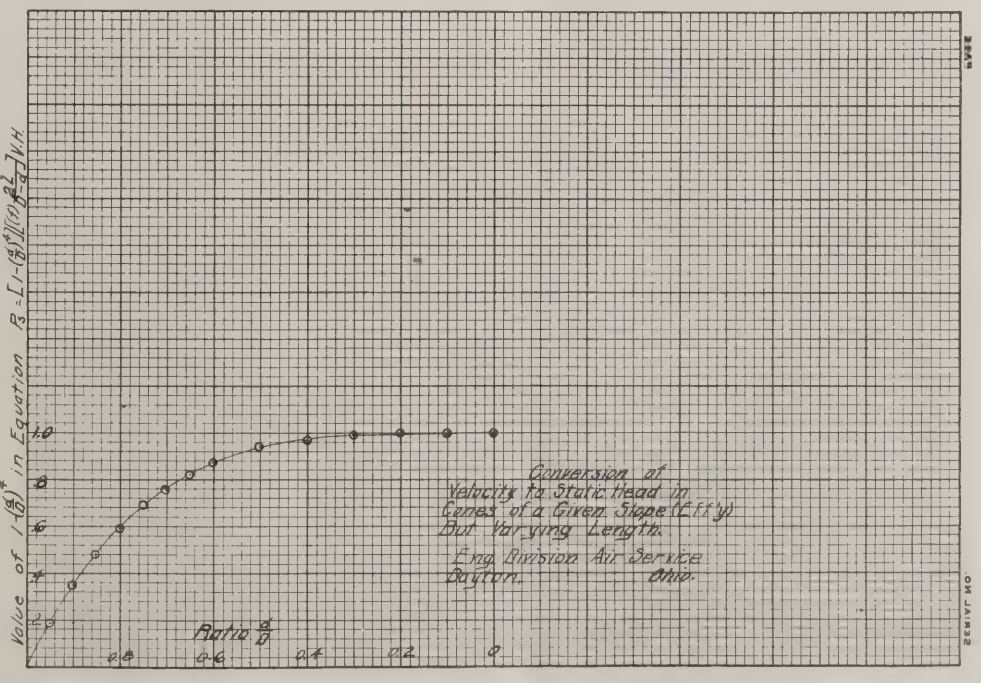
For example, in the electrical field, which really is only thirty years old, the range of practical application has extended further than the pioneers could predict. The salesman does not dare say what kind of lamp, or what kind of motor, or battery he will be selling next year. Nor does a factory manager dare say a year in advance that some new invention will not require retooling sufficient to establish in effect a new factory.

We are at the present time witnessing the incompetence of the factory and sales organizations to keep abreast of the advancing art; and we see as a result the great electrical organizations establishing research departments. Here competent scientists or engineers are expected to steep themselves in the principles concerned in the commerical novelties which each year appear. Thus the Westinghouse Electric, General Electric, Delco, etc., have research laboratories whose atmosphere is different from that of their main organization, being more like a university; the experimenters have free reign to test out a thousand and one propositions for the sake of the few which may in the future develop importance.

In other lines besides electricity we have, for instance, the Underwriter's Laboratory, which is equipped for many kinds of first hand testing. We have also the research department of the General Motors Corporation, whose engineers will be found experimenting with novel features of automobiles built either by themselves or some other experimenter here or abroad.

Research an Insurance for the Welfare of Industry: It must not be inferred that the establishment of a research department is a speculation, whose results are problematical. It is really, under proper management, a sound investment, or better, a sort of insurance policy taken out on the future welfare of the business. In a nutshell the above resolves itself into this:—that a research department is a device for keeping an industrial organization up-to-date. It is not suited to a conservative, non-progressive industry. In an industry which is full of zest there will be a demand in the various departments for the latest information touching what has been done in other plants and in other countries to solve particular problems. The Research Department will be expected to turn out concise and pertinent information on a large variety of general and detailed problems as they arise; it must therefore embrace a fund of general technical information. Kept up-to-date by organized reading, as well as by organized experiments, it must indeed be a veritable encyclopedia of experimental knowledge.

It is from considerations such as these that the aeronautical industry has come to recognize the wind tunnel as essential.



Wind Tunnel Regenerative Cone Chart

When we see that large numbers of aeroplane companies have established wind tunnels, we at once assume that there is some commercial advantage to be derived, (in Germany the Junkers, etc., and in England the R. A. F., Handley Page, etc., and in America, the Curtiss, Wright, Boeing Companies.) Since the wind tunnel is no a source of revenue, its benefits do not appear in terms of cash; but they frequently exceed the cost a hundred fold. This was recognized years ago by Eiffel, when he built his French wind tunnel in 1910 (?).

Eiffel, by the way, is a practical civil engineer, as attested by his work on the old original Panama Canal, and the Eiffel Tower. As a practical engineer he realized that his best contribution to the art of aeronautics could be made by establishing a wind tunnel. This he did and his reports are now classics in daily use by every designer of aeroplanes.

It is a significant fact that the Curtiss Company, at Long Island, found its small four-foot wind tunnel inadequate and now operates two complete and separate wind tunnels. These have been a source of revenue to the Company due to tests made for the Government.

The Navy Department under Admiral Taylor, early recognized the benefits of a wind tunnel and built one; it is significant that they have enlarged their laboratory until it now comprises two complete wind tunnels.

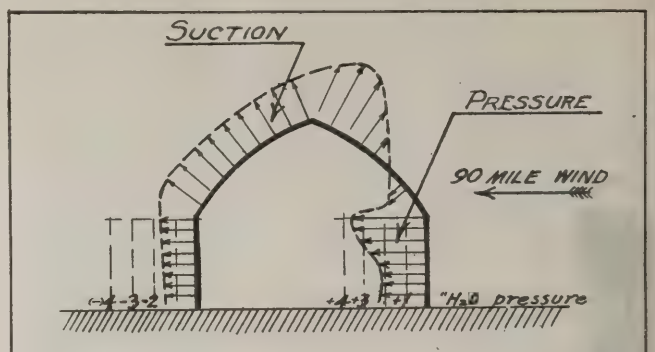
It is further significant of the usefulness of wind tunnels that Boston Tech, which had the first accurate wind tunnel in the country, is planning an additional larger one. Although their small wind tunnel has constituted a standard for the United States, they feel that they cannot keep abreast with aeronautical progress without a second and larger wind tunnel. It may be said that the small wind tunnel at Boston Tech has been in continued demand by individuals, commercial organizations, and by the Government; the latter at present continues a contract of several years standing for the testing of various experimental models in the wind tunnel.

The Opportunity of the Universities: There are a gratifying number of Universities preparing to take up aeronautical instruction today, more than ever before. They consider—and rightly—that they must have a wind tunnel laboratory for this instruction. Aerodynamics with its paradoxes and new conceptions to puzzle the student, is only half taught if no laboratory research is included. Neither teacher nor student can keep up to date without it. It is as essential to an aeronautical course as the Electrical Laboratory to an Electrical Course, or the Physics Laboratory to a Physics Course; without it the instruction loses its verve.

First Cost Need Not Be Great: A wind tunnel may be large or small, expensive or inexpensive as the builder desires; and need not be omitted from an aeronautics course on the grounds of expense. The first significant wind tunnel, that of the Wright Brothers,—was built by them at a time when their funds were small. The Mass. Institute of Technology four-foot tunnel cost only about $10,000.00, building and all. In Germany the wind tunnel is so well established as an adjunct to aeronautical courses that miniature plants for lecture room use may be bought for one hundred marks. Given a motor, balance, and available housing space, such a plant may be largely a matter of carpentry. Thanks to the regenerative cone principle, the power required may be several times less than the energy of the air current. Of course a large plant may cost a hundred thousand dollars, but for University use a small investment can be made the starting point of very useful work.

Wind Tunnel the Precursor to Knowledge of Fluid Dynamics: The wind tunnel, once established in a university for the purpose of aeronautical instruction, opens in addition a wide field for scientific research. The fundamental laws of fluid dynamics are still in the elementary rational stage, and require the sort of empirical research which we associate with colleges, and which will surely appertain in the future to them. Even if we imagine all practical and commercial value in aeronautics to disappear, there still will remain the realm of academic research for knowledge wherein the wind tunnel will continue to hold its place.

There are many applications of wind tunnel work outside the confinements of mechanical flight. The Government wind tunnel sections receive inquiries of diverse natures from blower concerns, ventilation engineers, fan manufacturers, windmill designers, designers of wind-bracing, etc.,— in fact from all the older branches of engineering wherein the phenomena of fluid dynamics play a part. Examples of wind tunnel tests dealing with these older branches of engineering are:—tests on wind resistance of roofs, and buildings; on windage of battleships; on the heat conduction of radiators due to air flow; on the calibration of air flow meters; on the action of ventilating apparatus; on the design of blowers and fans; on the nature of the meteorological movements of the wind; on the nature of the flow of gases in pipes; on the question of noise propagation in the air by ventilation apparatus.



CIVIL ENGINEERING PROBLEM FOR WIND TUNNEL STUDY
~ Roof and Wall Pressures due to Wind on Model of Large Building ~
(Sketch from Eiffel's "Nouvelles Recherches")

All the wind tunnels operating in the United States bear testimony to the variegated tests which are thus suggested. This is only natural, when we consider how large a part air flow plays in commercial life, and how little has been learned regarding it, prior to the advent of aeronautics. Except for the wind tunnel there is no way to find out precisely what the air does in any given application. Suppose, for example, a blower manufacturer suspects he can improve the efficiency of his product, perhaps by changing the shape of the impeller vanes. In the past, he availed himself of the cut-and-try method, making up one after another full sized impeller wheels until satisfactory results were obtained. Today, he may go to the wind tunnel, secure tests on small models of isolated blades, and from the coefficients thus determined, he can design his machine with full assurance of success. Wind tunnel coefficients have been found to apply with great success to the case of rotary blowers.

There is the whole field of the dynamics of meteorology; with its bearing on weather prediction. Our knowledge of air circulation has already been improved through exploration of the higher levels by air pilots; there is much to study in the laboratory;—the shape, size, position, etc., of the phenomena associated can be observed, to small scale, best in the wind tunnel. It is here that the vortex motion predicted by mathematicians has first been made visible; in such an experiment the observer sees before his eyes a working model of the tornado, or wind gust, or a cloud formation, or of the vortex sheets separating the various air layers of the atmosphere.

There is a close connection between meteorology and aerodynamics. Theory analyzes them both on a rational basis; and until now has been our nearest approach to knowledge. Theory is incomplete as applied to the terrestrial winds, but will gain precision from association with study of the laws of manflight. These laws, though remarkable, have hardly been available to the practical engineer, being in the past, unsupported by experiment.

It is this sort of empirical experience which is at last possible, thanks to the wind tunnel. Just so far as the theory is armed with empirical constants and coefficients, so far can we predict an actual design. And we are beginning to coordinate theory with practice; a noteworthy step toward this end having been accomplished by Prandtl, in his wind tunnel at Gottingen (Germany). By means of his experiments made there and his aerofoil theory, we can, to a certain extent, calculate a result, where formerly we had to test.

It is but a beginning. The whole field of fluid dynamics with its unexploited treasures of knowledge, remains to be explored; invisible and mysterious except as exposed in the wind tunnel, it must become in due time a new branch of science, touching our daily life in a hundred ways. We must avail ourselves of new instruments for this research; and none is superior to the wind tunnel. We should have many wind tunnels, for this means many investigators. We shall be justified in duplicating apparatus if thereby we bring to the work a plurality of intellects. For human intellects do not appear in duplicate; we need to focus scientific thought of every nature on our aerodynamic problems; and to multiply this personnel is the province of colleges. Should every state in the Union and every technical school establish an aeronautical course, it would not be too many, so long as a progressive wind tunnel program were included.

(*To be continued*)

DETERMINATION OF THE BEST WING LOADING FOR SINGLE SEATER PURSUIT AEROPLANES

By A. S. NILES, JR. and L. V. KERBER

Aeronautical Engineers, McCook Field

Object

THE object of the investigation covered by this report was to determine the effect of changes in wing loadings and aspect ratio on the performance and weight of single seater pursuit aeroplanes. his information was obtained by making six preliminary wing designs for an aeroplane of this type using two aspect ratios and three wing loadings. It was intended to use three aspect ratios, but that was found unnecessary. Only rough preliminary designs were made, as it was believed that the results were as good for comparative purposes as if more refined designs had been used. The type of structure and the approximations used are given below.

Conclusions

1. The lighter the wing loading the better will be the performance of a single seater pursuit aeroplane in most particulars. The greatest advantages are in ceiling and rate of climb, while there is a slight advantage in high speed when near the ceiling. In the cases considered, the time of climb to 15 000 ft. was 35 per cent longer for the most highly loaded aeroplane than for the most lightly loaded one; and there was a difference of 2 600 ft. between the service ceiling of the same two aeroplanes.

2. Higher speed near the ground is obtained by using a heavy loading, but this advantage disappears at altitude. At the ground the maximum difference in speed is 7.5 miles per hour. At 15,000 ft. it is only 3.5 m.p.h. and above 20,000 ft. the lightly loaded aeroplane has the higher speed. Thus, at the altitudes at which the pursuit aeroplane is expected to work, the lightly loaded aeroplane can climb higher and more quickly and can go as fast as the heavily loaded aeroplane.

3. The only effect of a change in aspect ratio on the performance is through the change in efficiency of the wings. As this effect is small in the range investigated no allowance was made for it. The lower the aspect ratio, however, the lower will be the weight of the wing structure, as the spars will be both lighter per foot of length and shorter.

4. The change in performance due to a variation of 12 per cent in the weight of the wing structure is negligible.

5. The dead weight per square foot of the wings increases with an increase of either aspect ratio or wing loading. The maximum difference between the designs made for this report was only about 12 per cent of the total weight of the wings.

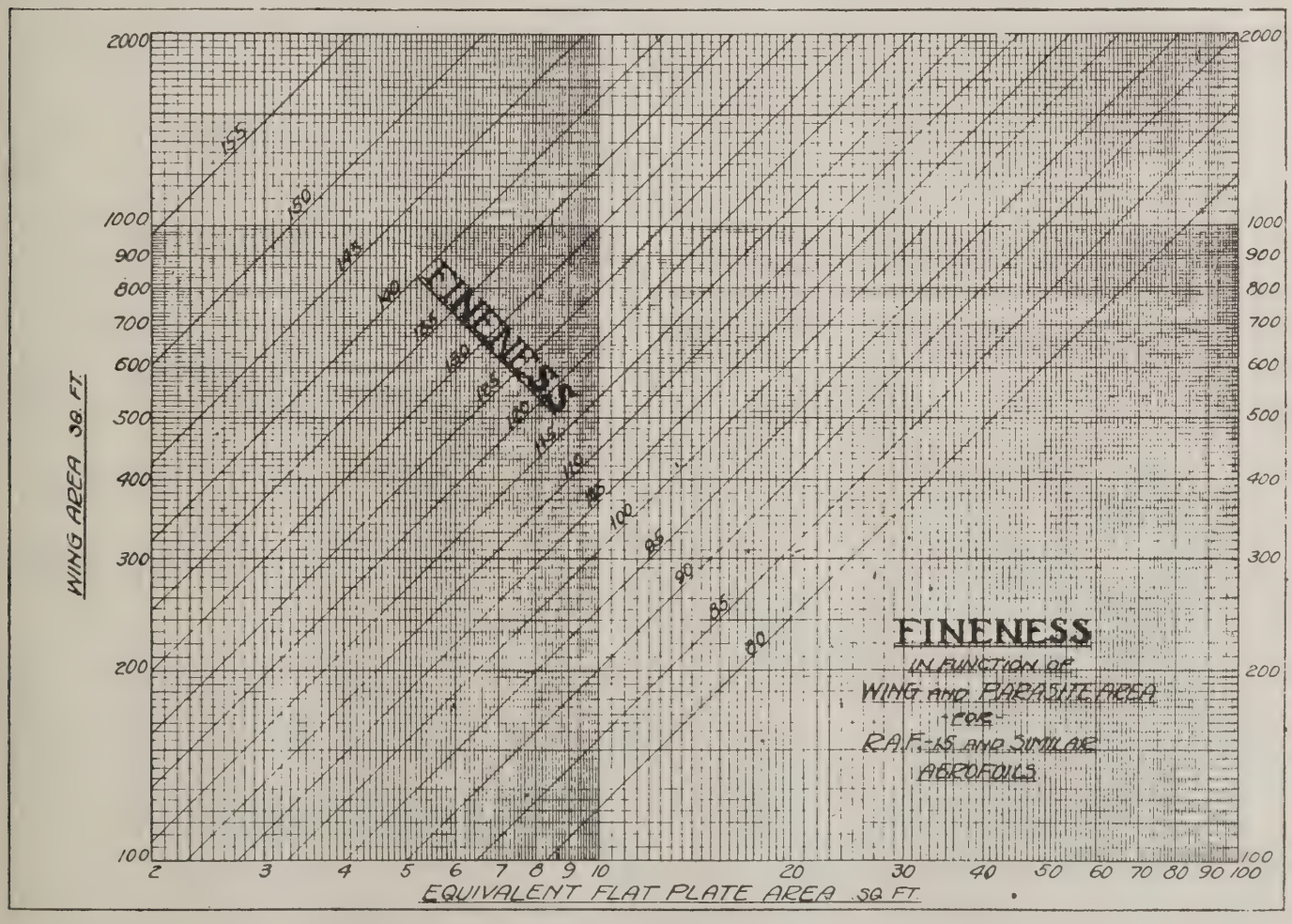
6. The lightest practicable wing loading should be used for single seater pursuit aeroplanes. Just what this loading should be in any particular case depends on considerations of vision, maneuverability, storage, etc., which cannot be compared quantitatively with performance. Therefore, the exact value used must be chosen by the judgment of the designer.

Method of Design

In order to reduce the labor of computation the simplest type of construction was assumed, and certain assumptions were made to simplify the work still further. As a result the spar and strut sizes selected would not be the correct sizes to use in an actual design, but as the same assumptions and approximations were used for all the designs, valid comparisons may be made from the data obtained. The designs were carried out following the methods outlined in "Stress Analysis and Design of Aeroplanes", except that drag forces were neglected and the design loads on the front and rear trusses were assumed to be 6.OW and 4.OW respectively, where W was the weight of the aeroplane minus wings. These values are slightly higher than would be obtained from the assumed spar locations and load factors and the center of pressure travel of the aerofoil used, but were used to simplify computations.

The following data were assumed in all designs:

Aerofoil section ..... R.A.F. 15



Location of the front spar in per cent of chord	13
Location of the rear spar in per cent of chord	65
Stagger	None
Efficiency of lower wing	90 per cent
Gap-chord ratio	1.0

Spars hinged at center section
Wing tips square
Both wings of same span and chord
Front and rear struts alike
Upper and lower spars alike

After designing the spars and struts their weight per sq. ft. of wing area was computed. The remainder of the wing structure, including fabric, drag, trussing, etc., was assumed to have the same weight per sq.ft. of wing area for all designs. Assuming the lightest wing to weigh 1.00 lb. per sq. ft. the weights of the other wings were easily computed.

The wing loading was then revised and the power loading computed using 328 horsepower for each design. This is the normal horsepower of the Packard-1237 engine, which is a typical engine for the type of aeroplane considered. For computing the fineness an equivalent flat plate area of 5.0 sq. ft. was assumed to represent the structural resistance and the fineness obtained from the chart, Fig. 1.

Description of Chart

In a report entitled "Aeroplane Performance and Design Chart"* it was pointed out that "Fineness" depended on the parasite resistance and on the loading per sq. ft. of wing surface. Recent developments have shown that "Fineness" can be expressed as a function of Equivalent Flat Plate Area and of wing area and section. Fig. 1 gives this function graphically for R.A.F. 15 wing section. It was obtained in the following manner:

given $W = \delta K_y FV^2$ (1)

and $\eta H.P. = (\delta K_x FV^3 + 0.64 \delta A_e V^3) / 550$ (2)

where F = wing area in sq. ft.
η = propeller efficiency
A_e = equivalent flat plate area of parasite resistance
δ = density = .00237
V = velocity in ft./sec.
K_x and K_y in absolute units

By the method of least squares, K_x can be expressed as a function of K_y

$$K_x = A + B K_y^2 \quad (3)$$

Where A = .007 and B = .146 for R.A.F. 15.
Simultaneous solution of equations (1), (2) and (3) yields the following:

$$550 \eta H.P. = \frac{\delta AW}{\phi} V^3 + \frac{B \phi W}{\delta V} + 0.64 \delta A_e V^3 \quad (4)$$

where $\phi = \frac{W}{F}$ = wing loading

Substituting various values of H.P., W, ϕ and A_e, this equation was solved for V and "Fineness" then found from the "Aeroplane Performance and Design Chart." Fig. 1 is thus obtained and it will be noted that the relation can be expressed by one curve, " Fineness" = f (A_e/F). Thus it is seen that the smaller the parasite area for a given wing area, the greater the "Fineness" and hence performance. An extended discussion of this subject will appear later in a special report on "Fineness."

* Air Service Information Circular, Vol. II, No. 183. McCook Field Report No. 1380.

Computation of Performance Data

Knowing the wing loading, power loading, and fineness, the performances were obtained from the Aeroplane Performance Chart in McCook Field Report No. 1380.

Table I gives the essential data on the six designs on which this report is based, in regard to both structural weight and performance.

TABLE I.

Weight and Performance Data on Assumed Designs

ϕ	Case I	Case II	Case III	Case IV	Case V	Case VI
Aspect ratio	5.5	5.5	5.5	5.0	5.0	5.0
Wing loading (approx.)	7.12 lbs. sq. ft.	8.46	9.98	7.04	8.62	9.98
Chord	70 inches	63.5	58	74	66	61
Wing area	361 sq. ft.	295	245	365	289	245.5
Spar area (one wing)	10.03 sq. in.	9.96	9.97	8.68	8.76	8.57
Spar wt. per ft.	1.881 lbs.	1.868	1.869	1.628	1.643	1.607
Spar wt. per ft. ^{2} of wing.	0.322 lbs.	0.352	0.386	0.264	0.299	0.316
Area of 1 strut	5.53 sq. in.	5.04	4.56	5.72	5.09	4.71
Length of strut	66 inches	60	55	70	62	57.5
Wt. of 4 struts	22.8 lbs.	18.9	15.68	25.0	19.7	16.95
Wt. of struts per sq. ft. of wing	0.061 lbs. sq. ft.	0.064	0.064	0.068	0.068	0.069
Wt. of ribs, etc.	0.668 lbs. sq. ft.	0.668	0.668	0.668	0.668	0.668
Wt. of wings per sq. ft.	1.051 lbs. sq. ft.	1.084	1.118	1.000	1.035	1.053
Wt. of wings	379 lbs.	320	274	365	299	259
Total wt.	2579 lbs.	2520	2474	2565	2499	2459
Wing loading	7.14 lbs. sq. ft.	8.54	10.10	7.03	8.65	10.01
Power loading	7.76 lbs. H. P.	7.68	7.54	7.82	7.62	7.50
Fineness	122.8	117.5	112.5	122.8	117.0	112.5
y*	1.66	1.89	2.11	1.66	1.90	2.10
Velocity at ground	146.3 m.p.h.	149.0	153.0	145.5	149.5	153.0
Velocity at 10,000 ft.	145.0 m.p.h.	146.6	148.5	144.5	146.9	148.4
Velocity at 15,000 ft.	138.6 m.p.h.	139.7	141.3	138.1	140.1	141.0
Velocity at S. C.	109.3 m.p.h.	113.5	119.0	108.9	114.0	118.8
Climb at ground	1785 ft. min.	1595	1465	1770	1585	1480
Time to 10,000 ft.	6.6 min.	7.5	8.5–	6.6	7.5	8.4
Time to 15,000 ft.	12.2 min.	14.1	16.5	12.3	14.1	16.2
Time to S. C.	41.0 min.	41.3	41.0	41.5	41.2	41.0
Service ceiling	24,025 ft.	22,900	21,400	24,050	22,800	21,860
Velocity at 20,000 ft. (Interpolated from curves)	126.8 m.p.h.	126.7	126.6	126.5	127.3	126.0–

* y is the ordinate on the performance chart for the given power loading and fineness.

Several interesting facts were brought out in the computations for the six designs in addition to the main conclusions given above.

1. For a given aspect ratio and gap-chord ratio and varying wing loadings, the net area of spars tends to be constant. The areas of the spars of the design in question were not exactly constant, but the differences were apparently due mainly if not entirely to the variations in the efficiency with which the material was used. With the higher wing loadings the moments are smaller but this is counteracted by the decrease in the depth of the spars, so that the same sectional area must be used.

2. The direct stresses in the lift trusses do not vary with either aspect ratio or wing loading, but only with the proportions of the truss. A change in the gap-chord ratio or the ratio of cantilever length to length of bay will cause a change in the direct stresses.

3. With a given gap-chord ratio the size of the struts varies with the chord, but for a given aspect ratio the weight of struts per sq. ft. of wing is constant.

4. In Fig. I, the fineness is independent of the aspect ratio. Therefore, the effect on performance of a change of aspect ratio is only the negligible changes due to the variation in the structural weight and efficiency of the wings.

INTERNATIONAL AIR TRAFFIC ASSOCIATION REGULATIONS

THE Air Traffic Companies, members of the International Air Traffic Association (I. A. T. A.) agreed at the last conference at Stockholm on some technical questions, aiming to bring in future a uniformity in the commercial aeroplanes to be used on their mutual airlines. In this way big inequalities regarding the flying and loading capacities, the equipment for the crew, the passengers and the airpost will be avoided, so that change and transhipment from one machine into the other can take place without difficulties.

All purely *constructive* requirements must be in accordance with the rules for admission, prescribed in the different countries, regarding the construction and safety.

With a view to *airtrafic* the following is pointed out:

Classification of Commercial Aeroplanes and Seaplanes

AEROPLANES

1st Class: Aeroplanes with a useful load to 200 K.G. and fuel for 600 K.M., wanted for flights of a few passengers (one or two persons), for the transport of small mails, telegrams and courier services, etc.

2nd Class: Aeroplanes with a useful load between 600-800 K.G.* and fuel for 600 K.M., wanted for the regular airmail service, the transport of 6-8 passengers (including a mechanic near the pilot) with luggage, resp. a freight of equal weight.

Third Class: Aeroplanes with a bigger capacity of useful load and a larger radius of action.

SEAPLANES

First Class: Seaplanes with a useful load to 200 K. G. and fuel for 400 K.M., wanted for flights of a few passengers (one or two persons), for the transport of small mails, telegrams and courier services, etc.

Second Class: Seaplanes with a fuel load between 500-800 K.G. and fuel for 600 K.M., wanted for the regular airmail service, the transport of 5-8 passengers (including a mechanic near the pilot) with luggage, resp. a freight of equal weight.

Third Class: Seaplanes with a bigger capacity of useful load and a larger radius of action.

* The margin of load in the aeroplanes and seaplanes in the Second Class must enable the constructors to get the technical and economical advantages, which can be obtained with the actually existing engines, in accordance with the classification of the qualities.

Night Flying Machines require a special classification. As the experience in this matter is still small, they will not be considered for the present.

For the mutual airservices of the associated companies and the airservices of the other separate companies first will be considered

2 kinds of aeroplanes (First and Second Class)

2 kinds of seaplanes (First and Second Class)

The following *outlines* therefore treat specially these 4 kinds of machines.

Flying Capacities: Flying, the machine may not have any peculiarity nor tricks in any way. It must be possible to fly at calm weather during at least 2 minutes without touching the controls.

Cruising Speed (at a height of 1000 M.): Aeroplane (First Class) 160-180 K.M.; Aeroplane (Second Class) 180 K.M.; Seaplane (First Class) 150 K.M.; Seaplane (Second Class) 160 K.M.

Surplus in Motor Power: It is not allowed that the required cruising speed and the good flying properties can only be obtained by using the whole motor power. To fulfill these conditions about 2/3 of the total H.P. force must be sufficient during the cruising speed, so that the remaining 1/3 H.P. comes to the benefit of the climb and the combating of very unfavourable weather conditions and the general reliability. It must be possible to switch off the half by double engined aeroplanes and nearly the half by more engined aeroplanes (for instance by 5-2), without loss of height during the flight.

Climb with Full Load: Aeroplanes and Seaplanes: 0-1000 M.—I, 6 min.; II, 8 min. 1-2000 M.—I, 12 min.; II, 15 min. The start of the aeroplanes may not be more than 200 M. and the run not more than 150 M.

"Take Off" of Seaplanes (by calm sea without wind): Seaplanes I, not more than 20 secs.; Seaplanes II, not more than 30 secs.

Seaworthiness: Seaplanes I—Dash of the waves, 2-3; wind velocity, 6-9 M. sec. Seaplanes II—Dash of the waves, 3-4; wind velocity, 9-12 M. sec. Safe steering in the above mentioned wind and sea conditions.

Reliability

With a view to *airtraffic* the following points are considered as primal conditions:

1/3 surplus in motor power (see above).

A clear view on the engines.

Possibility of a quick exchange of the power plants.

Short and clear conveyance of cables and pipes, as well as of power transmission.

Use of armoured or metallic propellers.

The greatest possible limitation of danger of fire by:

Application of engines at which the timing of the valves for inlet and exhaust do not get mixed;

Favourable position of the tanks;

Fireproof partition between the engine-room and the passengers room, resp. the place of the crew.

On seaplanes all floats and boats must be provided with the necessary number of bulkheads.

The total carrying capacity of the floats or boats must be at least 30 per cent. bigger than twice the weight of the machine with full load.

A soft system of springs with a long jump and a great capacity.

Conditions for the Pilot

The pilot must have a good view in the front and on both sides, as well as below in the direction of the flight. His seat must be equipped comfortably. The machine must be constructed so that the pilot is safe when it turns over.

The foot controls must be adoptable to the length of the body. When the passengers capacity is more than 6, the machine must be provided with a dual control and an entrance from the seat of the pilot into the passengers cabin.

Conditions for the Passengers

The passengers cabin must be strongly built and equipped with all practical comfort required for the journey. The experience of modern body building must be applied hereby.

Every seat must be at least 55-60 c.M. wide; every seat must be at least 55 c.M. broad.

The height above every seat must be at least 95 c.M. and the space for the knees must be at least 30 c.M.

On all seats it must be possible to stretch the legs.

It must be possible to open all doors from the inside.

It must be possible to have a conversation in a cabin—without speaking loudly—by the decrease of the noise of the engine and the construction of the cabin.

The possibility of speaking with the pilot must be provided.

Belts, strips or handles must be provided for all passengers.

The windows must be placed so that it is possible, when sitting, to have a good view. The most important windows must be so large that they can be used as emergency exits.

Ventilation and heating must be provided.

It must be possible for the passengers to get as quick as possible out of the machine, in any position, also when turned over.

Instruments

The pilot must have a clear view on the following instruments:

1 Height indicator,
1 Speed indicator,
1 Revolution counter,
1 Petrol gauge,
1 Compass,
1 Watch,

as well as on the indicators and levers, pointing out the position of the machine. (A thermometer for the radiator water, a direction indicator, an indicator for the horizontal position of the machine, are desirable.)

The compass must be placed so between the seat of the pilot and the direction of the flight, that it is possible to control it without turning the head.

Wireless

The aeroplanes and seaplanes of the Second Class must be equipped with wireless.

The receiving and sending wire must not dangle underneath the machine.

The sender and the receiver of the wireless must be placed in the room, which is specially made for the mechanic. If the signals are received by sounder system, it must be possible to hear them by the engine running on full throttle.

Tank Capacity

By a start with full load (see above) it must be understood that the aeroplanes, besides the useful load, must be charged with fuel for 600 K.M. (by the seaplanes I for 400 K.M.), but the tanks must have a capacity of:

Aeroplanes, First Class....for 800 K.M.
Aeroplanes, Second Class..for 1000 K.M.
Seaplanes, First Class.....for 600 K.M.
Seaplanes, Second Class....for 800 K.M.

Conditions for the Luggage

In the cabin for the passengers there must be sufficient room for small luggage. In a special luggage room it must be possible to put 2 trunks 80x50x25 c.M., when it is an aeroplane or seaplane of the First Class; and 6 trunks 80x50x25 c.M., when it is an aeroplane or seaplane of the Second Class. It must be possible to lock these luggage rooms.

Besides these, in aeroplanes and seaplanes of the Second Class a special space of the dimensions 50x50x50 c.M., which can be locked, is wanted for the airmail.

Possibility of Transport

When the wings are taken off, the machine must be transportable in an easy way and it must be possible to send it on a normal open railway car without complicated dismounting, according to the railway prescriptions concerning form and dimensions of freight. The seaplanes must be equipped with a liftstrop. This is also desirable for aeroplanes.

Classification of the Qualities

If the construction is the same and the general good flying properties also (including seaworthiness by seaplanes) the differences of qualities in one class of machines can be indicated by the following classification:

I.

Principal Technical Conditions:

1. Difference between the greatest and the lowest speed.
2. The lowest landing speed.
3. The greatest cruising speed.

3a. "Take off" qualities, seaworthiness and steering possibility of seaplanes.

4. View of the pilot.

II.

Principal Economical Conditions:

1. Lowest use of fuel pro K.G./K.M.
2. Price of purchase.
3. Weatherproof and repairing possibilities (lifetime).
4. Lowest costs of maintenance.

III.

Other Technical and Economical Conditions:

1. Surplus in motor power.
2. Preferable constructions of motor plants.
3. Flying properties of the machine by suppressing H.P. and great difference in weight of the load.
4. Immunity of the engines for fuel of different nature and for different temperature.
5. General construction concerning safety measures for the crew, the passengers and the freight. Dual control, constructive perfection of the passengers cabin, possibilities of getting out of the cabin in case of accident or turning over.
6. The best center of gravity by changeable weight (fuel, load); easy stowing possibility.
7. Practical comfort for the passengers, as well as practical conditions for the loading room.
8. Possibility to change the landing gear for landing on the ground, the sea or the snow, as well as general possibilities for mounting, dismounting and transport.
9. Easy change of the cabin for the transport of persons or freight, for nice or bad weather, for summer or winter service.

BALLOONING: ITS USE IN SCIENCE AND SPORT

By MAJOR C. C. TURNER*

IN the triumph of the aeroplane and the airship the round balloon, which has no means of propulsion or of direction-control, has suffered a certain neglect. Throughout its history the balloon has served sport and the showman rather than science, although it has rendered valuable services to meteorology. And in the form of *ballons sondes*—small unmanned balloons with automatic recording instruments—it is still used by the meteorologist, as also are kites. But since personal observations are often of great value, balloonists should still be able to do good work; for, unlike the aeroplane, the balloon is perfectly noiseless and without vibration.

During the first stage of the training of airship pilots the round balloon provides the cheapest and best introduction to the practical application of the science of aerostatics. No amount of theory or of lecture-room experimenting can give the pupil so practical a knowledge of the effects of small variations of temperature and atmospheric pressure, to which balloons and airships are extraordinarily sensitive. It might be possible to dispense with the course of "free ballooning," but it is the best and the least expensive way of securing the best results. During the war it was established as part of the training of airship and kite-balloon officers.

Fascinating Sport

Outside these the balloon's sole claim is in the field of sport and recreation; and here it inspires enthusiasm among its votaries, but makes little appeal to the mere spectator. It provides a safe and easy means of exploring the air, of seeing wonderful airscapes, and of getting in a few minutes out of the impure atmosphere of the town into clean air and bright sunlight. It gives a spice of adventure, and landings which have no element of danger except in very rough weather (when no one need go up), provide endless variety. It calls for the exercise of skill and judgment; yet almost any man or woman, with very little instruction, can become sufficiently expert to take charge.

The high price of coal gas, and the universal post-war depression of spirit, have prevented a revival of ballooning, and Great Britain has suffered more than other countries. For one thing, Great Britain is physically handicapped, having the sea at no great distance from any inland point, and the prevailing winds being across its narrower dimensions. A balloon goes with the wind, but the pilot can ascend or land at will. France, Germany and America enjoy the great advantage of large area.

Nevertheless, there would have been a revival of ballooning in this country but for the price of gas and the inexplicable difficulty of obtaining from the Aircraft Disposal Board the balloons that were used for training during the war. The present writer knows of cases where applications were perserveringly made in 1919 for these balloons. Applicants were assured they would be communicated with; but nothing came of it, and presumably the balloons are now rotting away. If it was the desire of the authorities to prevent any undue revival of what might have been regarded as an extravagance, surely they could have left it to the operation of circumstances: the price of gas would have checked it, to say nothing of labor difficulties. Anyway, there are dozens of men who obtained their balloon "ticket" during the war who have been eager to go in for the sport.

Possible Cheap Ballooning

The Gordon-Bennett race is a test of skill. Although there is nothing difficult in the art of ballooning, the prolongation of a voyage to the utmost possible, and the wise use of currents of the air, call for watchfulness and experience. A certain amount of luck comes in, but it is usually skill that wins the Gordon-Bennett.

Until gas gets cheaper it is not likely that ballooning will regain popularity. At present the cost of a quite ordinary trip in England would work out at not less than £5 per passenger. A way out of the difficulty is suggested by the employment of hot air instead of gas, but not by the use of a furnace merely filling the balloon at the start, as in the old days. The scheme referred to was proposed by a Frenchman, and consists of a specially contrived petrol (or other oil) stove carried under the neck of the balloon so that the pilot could regulate the heat as desired. This has not yet been brought to mechanical practicability, but there appears to be no insuperable difficulty in it.

* Reprinted from the *London Observer*.

French Aero Show

Wilbur Wright probably would rub his eyes in sheer amazement were he able to witness the wonders accomplished with his idea by French manufacturers as shown in the aviation exhibit at the Grand Palais. Many details of the machines have been kept secret for the opening of this show, which is the first the manufacturers have had in two years.

The inspection which the New York *Herald* correspondent was privileged to make of the latest machines shows that France does not intend to yield the supremacy either in civilian or military machines to other nations if she can help it. Simultaneous strides are being taken in both fields but while in the civilian branch the movement is entirely for greater carrying power and mammoth construction, so far as the military machines are concerned speed alone seems to be the guiding factor. Here are some of the latest wonders.

1. A flying hospital equipped with stretchers and able to carry a doctor and an assistant to perform regular operations in the air. There is an operating table, a full medical equipment and two patients can be carried on the stretchers. The machine is equipped with stabilizing appliances which will enable the doctors to work just as if they were in a city hospital. This is a Breguet biplane capable of developing a speed of 100 miles an hour.

2. An aerial monster, also a Breguet, capable of carrying twenty-four passengers as well as a crew of three and able to attain a speed of 150 kilometers an hour. It is the last word in aerial comforts, containing a bathroom, smoking room, card tables and a kitchenette. The seats are so arranged that they can be changed into beds for night voyages.

3. A Farman biplane with 100 foot wingspread and four 250 horsepower motors, capable of carrying twenty persons. It resembles a great sailing ship with six masts on each side of the cabin, the Farman running to wingspread in order to gain stability.

4. A Breguet hydroplane with places for five people, the fuselage and floaters being made entirely of metal.

5. A new Breguet triplane, all metal, with a group of 500 horsepower Breguet motors designed for war but not yet ordered by any Government. This will carry five machine guns and their crews or two tons of bombs.

6. A Bleriot seventeen passenger touring plane, with two seats on the tail of the machine for seasoned travellers. This machine has a lookout cabin for the navigator and is equipped with wireless telephone and telegraph, searchlights and signal flares, and also carries a petrol reserve above the wing tips as a solution for the fire danger problem.

7. A La Tecoere, 1,000 horsepower machine with three motors. Two of the motors are outside of the fuselage, attached to the cabin by braces rather than to the wing braces, and equipped with an interior drive.

8. A new all metal Fokker monoplane with two seventy horsepower Meyback motors, capable of carrying six passengers.

The French army is represented by two pursuit planes, a Nieuport and a Spad of twenty horsepower each, with two places, carrying two machine guns and capable of developing 130 miles an hour, or a 75 per cent. advance over war time construction. The army has also adopted a Breguet stretcher carrying biplane, with the stretchers arranged lengthwise, and no provision for attendants, as it is designed to carry urgent cases from the battlefields to the hospitals.

Postal Plane Gives Quick Carriage to Arlington Films

Mineola, L. I.—On the authorization of Postmaster General Will Hays a De Haviland type of mail plane arrived from Washington the evening of Nov. 11th with films and photographs of the Armistice Day exercises at Arlington Cemetery. The plane was piloted by Paul M. Collins. It carried 150 pounds of films and plates for various motion picture corporations.

NAVAL and MILITARY AERONAUTICS

General Summerall Commends Air Service

During a recent inspection by the new Commanding General of the Hawiian Department, Major-General C. P. Summerall, of the Air Service troops at Luke Field, H. T., an aerial demonstration of attack raiding, camera obscura training, acrobatics, two way radio, radio phone, and Fokker stunting was given, which resulted in the following letter of commendation from him to the C. O., Luke Field:

"1. I desire to communicate to you and through you to the officers and soldiers of your command an expression of my satisfaction with the efficiency in every department as evidenced during my inspection yesterday and of my commendation of the personnel in all grades whose loyalty and devotion to duty have produced such pleasing results.

2. The exhibition in the functioning of the Air Service in its different tactical missions was unsurpassed by anything that I have seen. The organization and the functioning of the different departments for the maintenance and operation of the command inspire confidence in the methods pursued for safety and efficiency. I especially wish to commend the experts and the officers in charge of the different scections for their resourcefulness in developing capacity and securing continuity where special training is required.

3. While I might commend each officer by name for his particular achievements, I wish especially to express my appreciation of the demonstration given by Lieut. Miller while flying as an escort during my journey to and from the Island. I wish also to commend the work that is being done by Lieut. Miller in the shops and of Captain Oldys who has demonstrated unusual efficiency in his capacity as Operations Officer."

Engineering School, McCook Field, Dayton, Ohio

At the present time the Engineering School at McCook Field is busily engaged in the study of shop machine work. Recently a tour of inspection was taken of the National Cash Register works, and this plan will be continued throughout the course of study so that the student might get first hand data as to practical methods of production and machine shop routine.

There are 16 officers now enrolled at the school, as follows: Majors A. H. Hobley, Follett Bradley, George E. Lovell, Jr., Henry L. Watson, Howard C. Davidson, Captains Hervey W. Cook, Henry Pascale, Robert L. Walsh, Lieutenants Burton F. Lewis, Oscar Monthan, Carlyle H. Ridenour, Robert S. Worthington, E. A. Palmer, Walter E. Richards, Harold R. Harris and Richard E. Thompson.

Exhibition of Armored Aeroplanes at Bolling Field

The recent exhibition at Bolling Field of an armored aeroplane built by the J. L. Aircraft Corporation of New York City was a most interesting one, inasmuch as this machine marks one of the very first all-metal aeroplanes entirely constructed in this country. While the outward appearance of the aeroplane is nearly identical with that of the J.L. 6 exhibited a year ago, numbers of which were purchased by various government agencies, the construction of the new machine is considerably different.

The plane, known as the "J.L. 12 Attack Plane," is a type in advance of the latest foreign all-metal planes. It is 32 feet long, with a wing spread of 49 feet, and carries 130 gallons of gasoline. It is equipped with a 12-cylinder 400 h.p. Liberty engine, and has a newly designed internal metal bracing system, employing considerably more steel than that in the J.L. 6, which employed mostly duralumin. The duralumin sheathing and wing coverings of the latest model are more than twice as thick as that used on the J.L. 6, and the duralumin itself, which has been developed and produced entirely in the United States, is said to be far superior to that produced in any other country.

All vulnerable parts of the plane and the crew are protected by 3/16-inch armor plate. The armament consists of 30 Thompson .45 calibre machine guns, so arranged as to fire downward at a slight angle to the vertical. Two machine guns are flexibly mounted so as to be used independently by the pilot for firing either upward, forward or to the side. The machine guns arranged to fire downward are so controlled that their action is begun and controlled by three levers, one firing half the battery, another the other half, and the third, or master lever, which puts all of the 28 guns in action with a single motion.

The machine is designed as a ground straffer. It was flown from Bolling Field over the Potomac River near the Army War College, and as a demonstration all of the guns fired into the river. The demonstration was apparently very successful. A speed of 140 miles per hour is claimed for this plane, with greatly improved climbing and maneuvering ability. When manned by pilot and gunner and equipped with 3,000 rounds of ammunition and fuel for 500 miles of flight, it weighs 5,000 pounds.

Navy to Test Dornier Boat

Washington.—The Navy Department is arranging for a special demonstration of the German Dornier all-metal flying boat, to be held at the naval aircraft factory in Philadelphia for the benefit of aeronautical manufacturers and engineers.

Secretary Denby said that it had been the policy of the Navy Department to purchase abroad examples of metal construction in order to study the latest development in the art. These tests at Philadelphia will include demonstration in flight of the Dornier flying boat, which is a post-war product of the Zeppelin Company, and was originally designed for commercial passenger service. Several other examples of foreign construction will be available for the detailed examination of the engineers invited to witness the demonstration.

Film Shipment by Air

A complete aerial delivery system for film shipments aggregating ten thousand pounds weekly from the San Francisco exchanges to scores of theatres in the Northern California and Nevada territory was arranged during the week of October 23rd to meet the threatened railroad strike.

The proposal for the aerial delivery was made to the San Francisco Film Exchange Board of Trade by Glenn Hurst, secretary of the Pacific Airline Company. Mr. Hurst has been for the past ten years engaged in the motion picture exhibition business in Nevada, but is now handling exploitation for the financing of the new company.

At a meeting of the members of the film board of trade on October 25th a large fund was subscribed to inaugurate the air service and defray the added cost of aeroplane delivery as against rail delivery which is paid by the theatre.

The San Francisco exchanges which supply nearly 350 theatres, apportioned the service between auto trucks and aeroplanes. Routes where trucks could traverse paved highways in a reasonable time were allotted to the ground service. More distant stations were allotted to the airlines. The air service was scheduled to start on October 31st and covered three trunk lines. Route No. 1 had its terminus at Eureka, California, 250 miles by air, with Santa Rosa and Willetts as intermediate landing stations. Route No. 2 terminated at Klamath Falls, Oregon, 350 miles by air, with landings at Chico, Red Bluff and Redding, California. Route No. 3 had its terminus at Reno, Nevada.

From each of the landing stations the theatres within a radius of twenty-five to thirty miles would call by automobile for their shows. Some seventy theatres were included in the proposed service with four round trips each week over the routes. With the suspension of rail service to Nevada points the air service was the only means for delivery. At this season of the year all automobile routes to Nevada over the Sierras are closed by early snows.

The fleet of planes operated by Walter T. Varney, consisting of one Bristol, four Lincoln Standards and two or three other craft were chartered for the bulk of the carriers. Practically all of the planes owned by private flyers in San Francisco would have been required to carry out the plan, including the Friesly Falcon, the giant two motored craft now stationed at the Marina which could have negotiated the routes with a ton of cargo. Mr. Varney gave all his planes and spare motors a complete overhaul in preparation for the service.

Rates for film shipments by air would have been about double express charges by rail. The charges which were fixed were very moderate considering the emergency.

The weekly rental collections of San Francisco film exchanges are about $60,000 and the take of theatres receiving the air delivery is an equal amount.

Close to 50,000 pounds of film shipments are round tripped weekly by parcel post and express in the San Francisco territory alone, and this district is estimated at 3½ per cent, of the United States.

FOREIGN NEWS

Prospective Developments in Holland

With a view to ascertaining the attitude of the Dutch Government towards civil and military aviation, the manager of S. Smith and Sons' Aviation Department, Mr. A. W. Hulbert, recently paid a visit to Holland.

He states that as a result of the Queen's speech at the opening of Parliament, calling for drastic economy, the Government does not propose to help the civilian transport companies to any extent for the next six months. They will, however, continue the present scheme of subsidizing the lines to the extent of two-thirds of the total loss incurred in working. This seems to suggest that it would pay a firm to lose money, either by investing the profits in new machines or experimental work in order to qualify for the subsidy; which is surely an Irishman's (or a double Dutchman's) way of encouraging civilian flying.

During an interview with a high official at the Government Aerodrome at Soesterburg Mr. Hulbert brought the conversation round to the question of the Dutch Government's programme for next year, and was informed that specifications were in course of preparation, and that in the early part of 1922 tenders would be invited from firms at home and abroad for machines built to these specifications. This means that British Aircraft Constructors will stand a chance of getting in, providing that their price and delivery compare with the Dutch manufacturers; Fokker being perhaps the most formidable competitor.

The types at present in use at Soesterburg are Fokker and Spyker school machines, a few Bristol Fighters, D.H.9s, and a number of small s.s. Fokker machines. Soesterburg is situated about 15 kms. E. of Utrecht, and combines an experimental station and an advanced training establishment for naval and military pilots. The training is divided up into three sections: aerial gunnery, general flying and W/T. With regard to photography the Dutch have a lot to learn yet before they can claim to have attained the standard of excellence set up by British aerial photographers, either civil or military.

In view of the complex network of canals throughout the whole of Holland, Mr. Hulbert is of the opinion that the Dutch aerial taxi of the future will be a two- or three-seater seaplane, about the size of an Avro "Baby," which will be able to take off and land on most of the inland waterways with comparative ease. Anything on a larger scale would be out of the question for serious work everywhere in Holland, as a larger machine, on account of its size, would be confined to a few of the largest canals and its sphere of usefulness narrowed considerably.

Paris-Bucharest in 14 Hours

For some time it has been the intention of the Franco-Roumanian Aviation Co., who operate the Paris-Strasburg-Prague-Warsaw air line, to extend their line to Bucharest. On October 22 the first direct flight was made, and occupied 14 hours, including the stops at Strasburg, Prague, and Budapest. By train the journey occupies about 63 hours, so that the saving effected is very considerable.

Austria's War Material

Official figures just issued in Vienna of war material destroyed or delivered up by Austria up to October 1 under the terms of the Armistice and Treaty of Peace, include 1,333 flying apparatus, 3,289 aeroplane motors, 15,000 magnetos and instruments, and 2,500 aeroplane machine guns.

France to Have an Aircraft Museum

To replace the temporary resting-places of the historical collection of objects relating to air navigation which have hitherto been deemed adequate in France for the purpose, a new "museum" is to be formally inaugurated on November 23 at Chalais Meudon. "La France" hangar is to be utilized to this end, and the public will then have an opportunity of conveniently studying the many interesting "relics," etc., which have been collected relating to the past history of aviation.

Poirée Fails to Beat Martinetti

As soon as it became known that the Italian aviator Martinetti had improved upon Poirée's time in the fight for the Coupe Michelin, Poirée set out to see if he could beat his own previous performance and also that of Martinetti. Altogether he made three attempts, none of which was successful, chiefly on account of bad weather conditions, but although he has failed to beat Martinetti's performance of 3,000 kilometres in 35 hours, he has put up the very fine performance of covering 7,000 kilometres in one week.

Mesopotamia Air Force

It is now officially announced that from February 1, 1922, the Irak (Mesopotamia) Group of the Royal Air Force, which is at present part of the Middle East Area, will be separated from that area, and will become an independent command. The officer commanding Irak Group will be directly responsible to the Air Ministry for the command and administration of the Air Force units located in that country.

Gliding Competition in France

Encouraged by the success attained during the German gliding competition in the Rhone hills this year, France has resolved to hold next year a somewhat similar competition. At present it is proposed to hold the competition from July 6 to 20, 1922. The competition is to be organized by the French Aerial Association, but before settling the rules and regulations it is proposed to call a "Congress" at the Grand Palais to discuss the possibilities of such a competition. The congress is to take place on November 26 and 27 in one of the lecture halls of the Grand Palais, and the only condition imposed for admission to this congress is that a communication should be made to the *Congrès d'Aviation sans Moteur*, addressed to the General Secretary, M. Georges Houard, 17, Boulevard des Batignolles, Paris (8e). The communication should bear on the following subjects: Theory or application of gliding flight; method of making the experiments; information relating to the Rhon experiments; rules and regulations of the French competition in 1922, or suggestions concerning the competition, such as suitable place for holding it, rules and regulations, etc. Communications should not exceed 1,200 words, and those accepted will be published in our French contemporary *Les Ailes*.

New Italian Airship

From Rome it is reported that Italy proposes to build another semi-rigid airship, the "Napoli," on somewhat similar lines to those of the "Roma," which was sold to America recently, but of rather greater length. The ship is stated to be designed for 100 passengers.

Antibes to Ajaccio in 3 Hours 10 Minutes

France is gradualy turning the port of Antibes into an important air station, and it is hoped to establish air lines running to Corsica, Sardinia and Tunis, using Antibes as the French terminus. On October 18 a seaplane flew from Antibes to Corsica (Ajaccio) in 3 hours 10 minutes, which is a very great saving of time as compared with the time taken by steamer.

The Pescara Helicopter

After numerous trials, and after having rebuilt his transmission and other details of his helicopter, M. Pateras Pescara is now reported to be satisfied with the behavior of the machine, and to have succeeded not only in making it rise on several occasions, but also in lifting at will one end or the other, in turning, and in descending slowly. No attempt has yet been made at high flights, nor at completing a circuit, as the garden in which the machine is being tried is too small to allow of this. We understand, however, that the machine is being dismantled, and will be exhibited at the forthcoming Paris Aero Show. After the closing of the show it is to be thoroughly tested in France, at Villacoublay, before the French Service Technique, when prolonged flights will, presumably, be attempted.

The Aveline Stabilizer

The inventor of the "Automatic Pilot," M. Georges Aveline, has been demonstrating his stabilizer in France. When we met him in London recently he told of experiments having been made on French machines at Villacoublay. He also referred to the possibilities of the invention being taken up by America and other countries, so that there would appear to be prospects of the stabilizer (which was described in detail in *Flight* of February 3, 1921) coming into fairly general use during 1922. Some little time ago a demonstration was given on one of the to Brussels, Rotterdam, Amsterdam and back. On this particular occasion the lateral stabilizer only was used, but we understand that the M.A. were machines belonging to the Messageries Aériennes, which flew from Paris so pleased with the results that they have asked for a demonstration with the elevator stabilizer fitted also.

A New Metal?

From Paris it is reported that two French inventors have discovered a new light metal, which, if the claims made for it are substantiated, should have a great future in the aviation industry. The new metal is stated to be lighter than Duralumin, stronger weight for weight, and much cheaper. The tests are stated to have been carried out in the laboratories of the Arts et Métiers, and to have proved that the metal does have extraordinary properties. The inventors are MM. Fontane and Geyer. We seem to have heard of similar wonderful metals before, but somehow they have a habit of not materializing. We trust the French inventors will have better luck, since such a metal would help metal construction considerably.

Italy Re-Names Her Aerodromes

Many Italian aerodromes are being re-named after Italian air heroes, the consent of the Ministry of War having been obtained for this procedure.

The Baggio (Milan) airship station is to be known by the name of Remo La Valle, the second in command of the M. 12 airship, who perished when this airship was shot down from Monte Hermada by the Austrians.

The Bologna (Piazza d'Armi Capara) aerodrome has been dedicated to the memory of Fausto Pesci.

The Capodichino (Naples) air port takes the namee of Ugo Niutta.

The Ghedi aerodrome will be dedicated to the memory of Luigi Olivari.

The aerodrome of the Cascina Costa (Gallarate) School will be dedicated to the memory of Gaspare Bolla.

The name of the Taliedo aerodrome has been altered to that of Emilio Pensuti, in honor of that pioneer airman, who was killed in an attempt to land a Caproni triplane which had caught fire at a height of 3,000 metres.

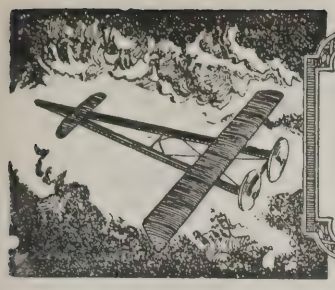
The Air Port of Prague

Prague is slowly but—let us hope—surely becoming an air port of some importance, a position to which her geographical situation would appear to entitle her. The aerodrome is situated at Kbely, a small village on a plateau to the northeast of Prague, forming a splendid natural site for an aerodrome. It is here that the machines from Paris, which depart from Le Bourget at six in the morning, arrive round about two in the afternoon, leaving again for Paris the next morning at 11:30. In addition to this daily service to Paris and Warsaw, Prague will, during the next few months, also have its service to Budapest, Belgrade, Bucharest, Dresden, Berlin, and Constantinople. For the extension to the Turkish capital a new machine has been ordered. This is, we learn with some surprise, one of the fur-engined Blériots (presumably the "Mammouth,") one version of which was exhibited at the last Paris show. The new machine is stated to have accommodations for sixteen passengers with luggage, and to have an average speed of 120 m.p.h., with four engines of 300 h.p. each. Even accepting the speed, 75 h.p. per pasenger does not impress one as a particularly good commercial roposition.

French Aeroplane Construction

A London financial journal states that the French Military Air Service will next year have over 40,000 aeroplanes, if the Army budget passes. The French Flying Corps would then be composed of 286 regiments, each of 12 squadrons. French aeroplane constructors are at present in a very strong position, mainly because the French Government did not cancel all its war contracts, but allowed constructors to execute the greater number of them. It was thought that this would be the best way of subsidizing the French air industry.

In addition, the French constructors had in hand substantial orders from Japan and South America. It is to this policy and to the most intelligent cooperation of the French military technical services with civilian aviation that France owes her present lead in the air.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



The Possibilities of Soaring Flight

BY soaring flight (in contrast with gliding flight) is meant, *motorless flight without loss of height.* According to the laws of the mechanics of flight, two sources of energy are available for soaring flight. One is, air currents having an upward trend; the other is, irregularities in the natural wind. Under the latter head, distinction can be made between two effective forms: (1) Great fluctuations in the strength (and also direction) of the wind, lasting several seconds; (2) The rapid fluctuation in wind direction which is commonly described as "turbulent wind."

The fluctuations of long duration can be utilized only by effecting considerable changes in the velocity and height of the machine. For instance, by climbing at the expense of relative velocity, in one single gust, and then, in the calm which follows, gliding with a downward acceleration. The procedure to follow in order to extract energy from the wind can be condensed into a simple rule: *One must attempt to equalize the fluctuations in the wind.* In so doing, the energy in the wind fluctuations is obviously reduced and the energy of the machine increased by a corresponding amount. Thus, for instance, one must present great resistance against a gust, small resistance against a lull; in an upward current the machine must be gradually elevated to increase the presure on the wings; in a downward current, depressed to decrease the pressure.

The fluctuations of short duration, on the other hand, can be utilized without any substantial change in velocity of the center of gravity of the machine.

Useful effect is available in sufficiently great fluctuations in wind direction even with rigid and non-warped aeroplane wings. With elastically mounted or flexible wings, the force obtained from changes in wind direction, if these be sufficiently great, may assume perceptible proportions. The effect may be imagined as resembling that of the so-called "fish-tail" propellers. This name has been used to designate an arrangement by which the waves of the sea have been utilized for the production of power. The arrangement consists of a number of flexible plates, rigidly attached with their leading edge to the sides of a ship. As the waves rise and fall, the plates bend like the tail of a fish, and produce power both when bent downwards and when bent upwards.

Sources of Energy Used by Birds

When we now come to the question of which of these sources of energy do soaring birds make use, the answer can only be that, if not exclusively, at any rate mainly, they take advantage of rising currents. Rising currents are always to be found in uneven country when a wind is blowing. They are also caused over the plains by meteorological influences.

Rising Air Currents

For their flying practice, birds naturally seek the rising air currents, and as these are frequently not of very great extent in space, the birds have to circle in order to remain in the rising air currents. By observing the soaring of birds of prey one may frequently see that they suddenly lose height and then commence to flap their wings, continuing in flapping flight until they are seen suddenly to rise. From this moment onwards they again commence to soar. They have again found their rising current which they had previously lost.

The soaring seagulls near a steamer make use of the air deflected by the steamer and commence to flap as soon as, for some reason or other, they leave their favorable position.

Gusts and Wind Fluctuations

That a bird intentionally makes use of gusts does not appear to occur generally. In order to do so, it would have constantly to make jumps up and down, which it has not been observed to do. On the other hand, it does not appear unlikely that many birds utilize the rapid fluctuations in the wind besides, after the manner of the fish-tail principle.

Probably, however, these forces suffice in no case to cover the entire work of flying, so that the axiom "no soaring without a wind with an upward trend," can probably be accepted as correct.

In regard to sea-birds, each individual wave gives the wind an upward deflection which the birds take advantage of.

According to a German writer, E. H. Hankin, whose recent book describes observations of birds, dragon-flies and flying fish, soaring by turbulent wind only is said to be possible when the earth is strongly heated, as occurs in the tropics.

Human Soaring Possibilities

In the case of human soaring flight, all the previously mentioned possibilities of making use of the energy in the air hold good in principle. The fish-tail effect may possibly be utilized by a suitable form of flexible wing-sections, although experiments with crewless models. It is quite probable that the wind fluctuations, which such wings would be designed to utilize, might frequently not be of such magnitude as to have a perceptible effect.

In view of the probable inconsiderable gain to be expected, one would not like to risk the uncertainty of the flying qualities of such a flexible aerofoil, which might easily lead to a useless, or even dangerous machine. A crewless model, on the other hand, could more easily be sacrificed.

The utilization of great wind fluctuations is a question of the skill of individual fliers. It is conceivable now and then to extract a slight gain from these, but too much should not be expected from this source. There then remains, as the most important help to human soaring flight, air currents with an upward trend.

The Advantages of Slow Rate of Descent

If it is desired to utilize to the fullest extent rising air currents, one must strive to build machines with a slow rate of descent. One is then in a position to utilize all rising air currents whose vertical component is greater than the rate of descent of the machine, provided that, at the same time, the upward slope of the wind is greater than the best gliding angle of the machine.

On a slope which is steeper than the best gliding angle of the machine, it is moreover possible to soar in winds whose velocity is smaller than that of the lowest gliding speed of the machine, provided the rate of ascent of the wind is greater than the rate of descent of the machine. In this case the machine will soar out horizontally into the free air and will obviously rise in doing so. In time, however, it would get outside the region of the ascending wind, but if the slope has sufficient breadth, the machine can be pointed diagonally to the slope and pass across it at the same height or climbing slowly. This method of flying can often be observed on seagulls over the beach. Under similar conditions the method should be possible of execution by human beings.

The above information is supplemented by four pages containing formulas to determine the conditions for the smallest possible rate of descent, in a pamphlet entitled, "Some Remarks Concerning Soaring Flight", issued by the National Advisory Committee for Aeronautics, under date of October, 1921.

Long Island Flight Association Formed

On November 7th, an association was formed at Baldwin, L. I., principally for the purpose of experimenting with and fostering the subject of gliding and soaring flight, and also for the furtherance of subjects pertaining to aeronautics in general.

Beginning with ten charter members, it is expected that there will be a great many young men near New York City who are anxious to join such an organization, and although no special efforts are being made to increase the size of the association, invitation to join is extended to those sufficiently interested in the subject.

The members are all employes of the Aircraft Department of the Ordnance Engineering Corporation. The membership roll is as follows: G. A. Page, Jr. (president); H. B. Shields, (vice-president); R. C. Greenwood (secretary-treasurer); W. Swenson, W. H. Schultz, W. F. Schult, A. O. Heinrich, G. W. Baumwart, G. F. McLaughlin, J. M. Beck, Jr.

A. O. Heinrich is one of the veteran Long Island pilots; furthermore, he has been a keen student of bird flight and at one time was engaged by the American Museum of Natural History to collect specimens of birds for exhibition mounting. Being interested in the subject from a flyer's standpoint, his knowledge will add much to the success of the contemplated soaring and gliding machines. George A. Page, Jr., also a pilot, has made interesting observations of bird flight, especially in the South, where he has been piloting an H-16 flying boat. Nearly all the other members have experimented with models and have been connected with the aircraft industry for several years.



'Twas Bestus

There was a stage star named Celestus:
When she danced the applause was tempestous;
She whirled and she tripped
'Til her shoulder-straps slipped—
And they had to ring down the asbestos.

—*Lord Jeff*

SHE (*kissing him again*)—You know I never do this to anyone else.
HE (*absently*)—So my friends tell me.—*Purple Cow.*

CLASSICAL DANCER—Doctor, I want to be vaccinated somewhere where it won't show.
DOCTOR—My dear young lady, I'm afraid I'll have to do it internally.—*Jester.*

Crushed

No. 13 SHOE (*at a dance, having just stepped on a girl's foot*)—Pardon me, but I couldn't help it.
No 4—Of course; I should have climbed on a chair when I saw you coming.—*Record.*

She signed the first one—Your H. P. Q.
The second—Yours sincerely.
The next one—Very sincerely.
Then it was—As ever.
Soon she wrote—Your own—
And later—Love.
Finally it came—Your beloved wife.
After that she merely signed them:
Be brave but careful, boys!

Behind the Scenes

INSTRUCTOR TO ACTOR—And then you clasp her in your arms and kiss her madly.
ACTOR—Is that all?
INSTRUCTOR—Sure, you idiot! Don't forget there will be people looking.

"Were you ever paddled in a canoe?"
"No, but I've been thrashed in a barn."

EENY—I hear Jim has the golf habit.
MEENY—Oh yes, it's one of these loud, hairy things.

Should a body meet a body
Going through the rye,
And a body gets a swig,
Should a body sigh?

Should a body hang around
Wade right through the rye
And the body get real lit,
Should a body cry?

Boys, we ask yuh!

"My girl reminds me of a cow."
"How come?"
"She recognizes the bull every time I try to talk."

The Charge of the ? Brigade

(With Apologies to Tennyson)
Snores to the right of him,
Snores to the left of him—
Snores all about him—
Rumbled and thundered.
Nodded a head in sleep,
Lost there in slumber deep
While on the prof did keep,
And all the class slumbered.

Called on one sleepy stude,
Asked him a question rude
When on his feet he stood,
My!—how he blundered.
His—not to reason why,
His—but to do or die;
He made such a noble try,
Even prof wondered.

So through the happy days,
Under the sun's warm rays,
Idly the student plays—
Rarely he ponders.
How do they get that way?
Training for the world with play;
"Still, they're pretty good," I'll say,
And so the world wonders.

I saw her leap into the foam;
This maid so fair, so young, so trim;
I sat and watched her as she sank
And knew the while she could not swim.

She sank forever 'neath the waves;
I could not aid her in her plight;
It sure was good, don't miss it, Jim—
I saw it at the show last night.

—*Orange Owl.*

WILLIS—Between the two of us, what do you think of her?
GILLIS—Not so good, but alone—I'd love her.—*Tiger.*

To a Dry-Ad

Whatever else may happen now,
The country has gone dry;
The sailor still will have his port,
The farmer have his rye.
The cotton still will have its gin,
The seacoast have its bar,
And each of us will have a bier,
No matter who we are.

—*Punch Bowl.*

Modern Mathematics

The shortest distance between two pints is a straight line connecting two drug stores.—*Far Seas.*

Hold That Lyin'

TEACHER—What made you so late this morning?
JOHNNY—A car hit me and knocked me so cold I didn't thaw out for an hour.—*Chaparral.*

BARBER (*to sleepy customer*)—I cannot shave you, sir, unless you hold up your head.
SLEEPY CUSTOMER—All right, give me a hair cut, then.

—*Jester.*

Not To Speak Of

I see the girls gave back all frat pins
Those you see are very few—
The truth is simple and convincing
There's nothing left to pin them to.

—*Froth.*

"Father, did God make me?"
"Yes, my child."
"And did he make you, too?"
"Yes."
"Well, he's doing better work now, isn't he?"

Virginia Reel.

UNIVERSITY OF MARYLAND LIBRARY
NOV 30 1921

AERIAL AGE WEEKLY

OL. 14. No. 12 NOVEMBER 28, 1921 10 CENTS A COPY



Airscape of Valley Forge, Pennsylvania, One of America's Famous Battlegrounds.
Photographed by the Aero Service Corporation, Philadelphia

The Fallacy of the Slotted Wing—The Choice of A Wind Tunnel—The Curtiss CD-12 Engine

SHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
iptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Po[illegible]fice at New York under the Act of March 3rd, 1879

MADE IN ITALY—USED THROUGHOUT THE WORLD

Ansaldo S. V. A. Aeroplanes

Reliability—Speed—Economy

TO

AMERICAN ANSALDO ACHIEVEMENTS

ADD

FIRST PLACE—LARSEN EFFICIENCY CONTEST:

Winner Larsen Trophy and $3,000 cash. Model Nine two place SVA flown by Capt. E. F. White, carrying a useful load of 1,161 pounds first, junkers second and third.

FIRST AND THIRD PLACES AMERICAN LEGION DERBY:

First, Winner Legion Trophy and $3,000 cash. Ansaldo Curtiss Balilla flown by Lloyd Bertaud.

Third, Model Nine SVA, flown by Capt. Earl F. White.

FOURTH PLACE PULITZER RACE, 1921

Ansaldo Curtiss Balilla.

Note: The SVA Model Nine which won the Larsen Trophy and placed in the Legion Derby is a stock model.

A Demonstration Will Convince You

AERO IMPORT CORPORATION

1819 BROADWAY NEW YORK

WRIGHT PATENTS LICENSEE

November 28, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 12

TABLE OF CONTENTS

The Fallacy of the Slotted Wing... 267

The News of the Week..... 268

The Aircraft Trade Review..... 269

The Choice of a Wind Tunnel..... 270

Aero Club of Pennsylvania..... 272

The Curtiss Model CD-12 400 H.P. Aeronautical Engine 273

The Maneuvres of Getting Off and Landing 277

Naval and Military Aeronautics... 279

Foreign News 280

Elementary Aeronautics and Model Notes 281

Aeronitis 282

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

AIR LAIRD PLANES WICHITA KANSAS

The Laird Swallow

"America's First Commercial Airplane"

THE Swallow's carrying capacity—three passengers, baggage and full fuel load—is one of the reasons that it is fast becoming America's most popular commercial ship. Let us send you our booklet.



Now Priced at $4,500

E. M. LAIRD COMPANY

Manufacturers

WICHITA, KANSAS

General Sales Offices

2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.
2216 So. Michigan Ave., Chicago, Ill.

Please send me details of your new sales plan and copy of booklet.

Name .....

Address .....

.....

AA

Curtiss



WORLD'S RECORD

"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

CURTISS AEROPLANE & MOTOR CORPORATION

GARDEN CITY LONG ISLAND, N. Y.

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., November 28, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, NOVEMBER 28, 1921 NO. 12

THE FALLACY OF THE SLOTTED WING

THE past year has seen the development of a number of devices and methods for increasing the lifting power of wings. The most notable of these are the Handley-Page slotted wing, the Martin leading and trailing edge wing flaps, and the Dayton-Wright split trailing edge. It is difficult to decide which of these developments possesses the most merit. The Handley-Page slotted wing is based upon more extensive tests and has been subjected to more critical study than the other devices. It is undoubtedly possible to secure a much higher lift with two or three slots parallel to the leading edge than by any other known method. It is recognized, of course, that all of these devices are in the experimental stage. Only the Handley-Page has been tried in a full scale model in flight, and that was a rather crude attempt. All the mechanisms necessary for the operation of the different arrangements must be developed. From this point of view the Martin flaps offer the least encouragement, since with them large sections of the wing, especially the leading edge where the air forces are greatest, must be moved through a considerable angle, the forces or stresses in the controlling mechanism must be very large. On the other hand, if the upper end of the Handley-Page slots can be closed by a sort of balanced valve, the possibility of successfully working out the mechanism seems good.

There is another side to this important question, however, which hitherto has not been discussed. Suppose for the moment that Mr. Handley-Page's wing were perfected so that the lift were doubled or trebled, and also assume that the weight of the operating mechanism was not excessive, and even that this mechanism functioned perfectly. Does it necessarily follow that such a wing would revolutionize aeroplane standards? All of the engineers working on this problem of very high lift wings would answer "yes." Mr. Handley-Page believes so.

Why would not Handley-Page's invention be of the utmost value if it would work successfully? Have not engineers always striven for wings with higher and higher lift and, of course, a reasonable efficiency? This is so, yet Mr. Handley-Page's invention will by no means have a universal application. On military types it would have but little practical value, and indeed, if by means of it the wing area were reduced to give the landing speeds that are found to be satisfactory at the present time, it would be a serious detriment to the efficiency of the design. The factor which has been forgotten, or deliberately neglected, is the effect of reducing the wing area on what has been termed the "fineness," or cleanness of an aeroplane, as this conception has been developed by Mr. Kerber.

"Fineness" is just as important in determining aeroplane performance as pounds per horsepower or pounds per square foot. It is determined by the ratio of the wing area to the equivalent flat-plate area of an aeroplane. By the latter term is meant the area of a flat-plate which would have a resistance equivalent to the resistance of the chassis, struts, wires, fuselage and empennage. For instance, a standard DH-4 with 440 sq. ft. of wing area has a fineness of 100. With areas 50, 75, 100, 125, and 150 per cent of this area the finenesses become 85, 93.5, 100, 107, and 112 respectively. The speed, due to the greater wing loading, of course, becomes somewhat higher as the area is decreased. Were the fineness to remain constant the speeds with the above areas would be 152, 134, 122.5, 113.5 and 107, but owing to the altered finenesses, the true speeds are 127, 125, 122.5, 121, and 119 M.P.H. The effect on speed of decreased fineness, due to reduced wing area, is serious. It greatly lessens the only advantage given by smaller wing area. The very serious disadvantage of high wing load is its effect on rate of climb and ceiling. With constant fineness these flight characteristics fall off rather rapidly with increase in wing loading, and when the effect of lowered fineness is also taken into account the full penalty for reducing wing area is brought out. Taking the same wing areas as before, the corresponding rates of climb are 635, 880, 990, 1000, 1120 F.P.M. and the service ceiling 8700, 14200, 17200, 19200 and 20600 ft. Such a comparison makes clear the loss in performance due to reducing wing area, and the advantage gained in increasing it.

The weight of the DH-4 with 440 sq. ft. was taken at 3800 lbs. In varying the wing area, allowance was made for the variation in the weight of the wings, by assuming that the weight per sq. ft. remained a constant which has been shown to be very nearly correct.

On practically all military types, rate of climb and service ceiling are of the greatest importance. They are the factors which determine the maneuverability of an aeroplane. High speed is of no value unless it is accompanied by good climb and ceiling. In aeroplanes intended for ground attack or low observation, where ceiling is not important, a fairly high rate of climb is still necessary in taking off and getting out of the restricted fields of front line airdomes. Low wing loading

(*Continued on page 276*)



The News of the Week



Aero Club Annual Meeting

The twelfth annual meeting of the Aero Club of America was held on Monday evening, November 14, 1921. The following Governors were elected under Class A, term expiring 1924: James A. Blair, Jr., George H. Houston, Richard F. Hoyt, Herbert Fish, S. R. Bertron and Lorillard Spencer. The following Governors were elected for one year, under Class B: Godfrey L. Cabot, Howard E. Coffin, Rear Admiral B. A. Fiske, Charles J. Biddle, Albert Bond Lambert, George M. Myers, John Larkin, Benedict Crowell, Gould Dietz. The officers to serve for the coming year will be elected at the next meeting of the Governing Board.

Marshal Ferdinand Foch, Admiral Sir David Beatty and General Armando Diaz were elected honorary members.

Reports of the various committees were read, including the Contest Committee, which announced the various meets that had been sanctioned throughout the year and strongly advocated aviation competition which has done more than any other one thing to develop real progress in the building of new types of machines and increasing the skill of pilots.

A very interesting report from Mr. Godfrey L. Cabot, delegate of the Aero Club of America to the F. A. I. conference in Madrid, was read in which he stated the Congress was opened by the King and Queen of Spain with impressive ceremonies. The Aero Clubs of China and Chile were elected to membership, and Austria was reinstated as a member of the F. A. I. World's records for spherical balloons of different sizes were provided for to increase interest in free ballooning.

The rules were modified in the case of altitude records for aeroplanes permitting them to land at some other place than the point of departure provided the instruments were returned intact and duly sealed.

A form of Triptyque was adopted which will do away with many of the difficulties now encountered in passing across the border from one country to another and complying with the customs regulations. By registering aeroplanes with their club it becomes responsible for the duties and vouches for the return of aeroplanes crossing the frontier. This is similar to the arrangement made by the automobile clubs of Europe to enable their members to cross the frontier without being delayed by tedious formalities. The request by America to have hydroplane records classified separately was adopted and referred to the Technical Committee to determine the various details involved. The committee will meet in January to fix the date for the next meeting in 1922.

A vote of thanks was tendered to the Foreign Service Committee for their good work in representing the Aero Club of America at the various meets and conferences held in Europe during the past year, including the Gordon Bennett Aviation and Balloon Races and the Deutsch de la Meurthe speed prize contest.

Resolutions were adopted commending the work and the recent achievements of the Army and Navy in demonstrating the efficiency of the aeroplane as agency of the national defense.

Annual Meeting, A. N. A. S. A.

Pursuant to notices sent to all members of the Army and Navy Air Service Association the annual meeting for election of officers and members of the Board of Control and for action on proposed revisions in the constitution and by-laws, mentioned in the notices which were sent to all members in August, was held in the Trophy Room of the office of the Chief of Air Service, Munitions Building, Washington, D. C., at 4.30 o'clock p. m., on October 3, 1921. There were present by proxies and in person votes in excess of 50 per cent of the membership of the Association. The following officers and Board Members were elected for the terms specified below and the revisions to the Constitution which had been submitted to the membership were adopted. A copy of these revisions will be sent to any member or other person who may be interested.

President (for term expiring October, 1922): Major-General Charles T. Menoher, U. S. Army.

First Vice-President (for term expiring October, 1922): Rear-Admiral W. A. Moffett, U. S. Navy.

Second Vice-President (for term expiring October, 1922): Brigadier-General William Mitchell, U. S. Army.

Third Vice-President (for term expiring October, 1922): Lieutenant-Colonel A. L. Fuller, U. S. Army.

Fourth Vice-President (for term expiring October, 1922): Commander Kenneth Whiting, U. S. Navy.

Secretary (for term expiring October, 1922): Earl N. Findley, formerly captain, A. S. A.

Assistant Secretary (for term expiring October, 1922): 1st Lieutenant W. E. Connolly, U. S. Army.

Treasurer (for term expiring October, 1922): Lieutenant-Colonel W. E. Gillmore, U. S. Army.

Assistant Treasurer (for term expiring October, 1922): Commander P. N. L. Bellinger, U. S. Navy.

Chairman of the Board of Control (for term expiring October, 1922): Major T. C. Turner, U. S. M. C.

Members of Board of Control (for term expiring October, 1922): Commander John H. Towers, U. S. Navy; Lieutenant-Colonel J. E. Fechet, U. S. Army; Horace Green, Major, R. C.; A. B. Lambert, formerly major, A. S. A.

Members of Board of Control (for term expiring October, 1923): Commander V. K. Coman, U. S. Navy; H. E. Hartney, formerly lieutenant-colonel, A. S. A.; Major W. G. Kilner, U. S. Army; Maurice G. Cleary, formerly captain, A. S. A.

Members of Board of Control (for term expiring October, 1924): B. F. Castle, formerly lieutenant-colonel, A. S. A.; Major H. M. Hickam, U. S. Army; Major Oscar Westover, U. S. Army; A. J. Ely, Major R. C.

Predicts Day's Trip Around the World

Paris.—The first International Congress of Aerial Navigation opened November 15 in connection with the Aeronautical Salon in the Grand Palais, twenty-six countries being represented. Eight questions will be examined by the congress—five concerning the present technical conditions of aeroplanes and three regarding navigation by air. The latter will, it is hoped, lead to the establishment of standard international rules governing transport by air.

The presence of Fokker, the famous inventor, at the salon, where he is exhibiting his latest type of aeroplane, is arousing much bitter comment in Paris. Fokker's association with Germany during the war is not forgotten or forgiven, and the fact that he has again become a Dutch citizen does not prevent the French from asking that he be requested to abstain from appearing on the occasion of the official visit of President Millerand to the exposition.

The celebrated aeroplane designer, Breuget, addressing a meeting of French scientists, said he had plans for building an aeroplane which would be able to fly from Paris to Buenos Aires in three days, making only five stops on the way. The cost of the journey, he said, would roughly correspond with that of a first-class passage today on an ocean liner. The machine, which M. Breuget expects to produce before many years have elapsed, will have, he says, 1,200 horse power and a speed of 253 kilometers an hour, and will weigh twelve or thirteen tons. It will carry twenty passengers, one ton of baggage, a crew of seven and four tons of gasoline.

Continuing his address, M. Breuget traced the future development of flying at high altiudes with the turbo-compressor invented by Rateau, which enables engines to maintain their power in rarefied air. Basing his arguments on strict mathematical calculations, M. Breuget told of an aeroplane which, leaving Paris and flying at an altitude of 12,000 meters, would fly completely around the earth and return to Paris twenty-four hours later. The ultimate speed of machines flying at this height, he said, would be 800 meters per second, which is faster than that of an artillery projectile.

Air Control at Sea Vital

Discussing the development of the fighters of the air before the Society of Naval Architects and Marine Engineers, at its annual meeting in New York City, Mason S. Chace, naval architect of Boston, asserted that the navies of the world were now face to face with the necessity of developing aerial means of offense and defense.

"I believe the supreme position of the battleship is more threatened today than it has ever been, if that position is not already lost," he said. "On the supposition that a small number of the largest bombs carried by aeroplanes can destroy a battleship, we may conclude that in the naval battles of the future victory will go to the forces which control the air."

Congress Asked to Accept Rockaway Station

Washington.—Authority to accept from the City of New York, without expense to the Federal Government, the site of the naval aviation station at Rockaway Beach was requested of Congress November 17 by Secretary Denby.

The tract comprises ninety-four acres, and on it are hangars, shops, storehouses and barracks, which, Mr. Denby said, would be of little value if the station were permanently abandoned.

Aid Ecuador's Aviation

Washington.—France and Italy have entered into an agreement with Ecuador with the object of organizing and developing that country's military, maritime, postal and commercial aviation, the Department of Commerce was advised November 17 in a consular report from Guyaquil.

The agreement provides for the establishment of aviation missions in Ecuador to aid in the development of aviation.

The AIRCRAFT TRADE REVIEW

American Airways Activities

Mr. Augustus Post, recording secretary of the Aero Club of America and pioneer aeronaut, and Major Baldwin, U. S. Inspector of Lighter-Than-Air Craft at Akron, Ohio, inspected the School of the American Airways at College Point, L. I., on November 16th.

Mr. Post gave a lecture on the Performance and Future of Aviation. Major Baldwin spoke on his work, which has been quite extensive.

On the 18th Mr. Ralph Upson gave an illustrated lecture on lighter-than-air craft at the American Airways School before the men taking the course in Aeroplane Mechanics.

Mr. Henri Francimont, foreign expert and formerly Curtiss' wind-tunnel authority, has been added to the faculty of the school, being in charge of technical subjects.

C. L. Maguire Company's Text Book

The C. L. Maguire Text Book of Aeronautical Lubrication is found to be of intense interest and value to the industry. Besides containing information of general kind the book includes charts and statistics relating to aeronautic engines. It outlines the conditions that arise in the development of motor trouble in the engines, describing in detail the cause, the effect and the remedies. This book has been prepared with the assistance of various experts of McCook Field, lubricating expert engineers of St. Louis and Washington.

"Jersey Road" to Philadelphia, Washington and the South

We are indebted to G. S. Ireland of the Curtiss Eastern Airplane Corporation for the following information:

"We thought your readers would be interested to know what is known as the 'Jersey Road' to Philadelphia, Washington and the South, starting from Mineola. This air route, we believe, is far better than the old one which mail pilots and army flyers use, such as picking up the Pennsylvania Railroad at Jersey City, crossing the Delaware at Trenton into the State of Pennsylvania and following the Delaware River to Philadelphia.

"You start at Mineola, flying in a due southwest course, picking up a course half way between the town of Freehold, N. J., and the old Pennsylvania Railroad tracks, coming to Bordentown, passing Camp Dix on the left and Mount Holly, N. J., on the right, flying straight over Medford, N. J., until you pick up the first railroad, which is the Pennsylvania line, between Camden and Atlantic City. Before you come to the Reading Railroad to Atlantic City, you will see the Curtiss Flying Field, which can easily be picked up by the two white hangars and green roofs and the word CURTISS printed in large letters on the roof. This field is a four-way field and consists of 100 acres, adjacent to other fields which can be used for emergency landings.

"To continue your route to Washington, you should head straight for Glassboro, which is the next railroad crossing, then for the Delaware River, crossing the river below Salem and picking up the Canal which runs into the Chesapeake Bay and then following the old route to Baltimore and Washington.

"The advantages of this route we find are due to the fields which have supplies and give service such as the Aeromarine Field at Keyport, Camp Dix and our field at Pine Valley. It is also shorter and its great advantage is the fact that you can always find an emergency field to land anywhere between Mineola and Pine Valley in case of a forced landing. The Curtiss Field at Pine Valley is the nearest large field to Philadelphia and has telephone, train, trolley and good road facilities to Philadelphia. It is a four-way field and is not surrounded by any obstacles which cannot be seen from the air, such as transmission wires and fences. Such machines as the Curtiss Eagle, the Junker and the Foker use our field when wishing to reach Philadelphia."

A New Map of Universal Interest

A new base map of the North Pacific Ocean on the transverse polyconic projection has been prepared by W. E. Johnson, Cartographer of the U. S. Coast and Geodetic Survey of the Department of Commerce, and is now available for distribution. It is published in clear form and convenient size (dimensions 14 by 41 inches) for desk use. (Map No. 3080, North Pacific Ocean, scale 1:20,000,000, price 25 cents.)

This map is designed primarily as a base on which statistical data of various special kinds may be shown. In consequence of this purpose only features of major importance are shown on it and these features are emphasized to an extent not possible on a map which contains the vast amount of detail usually included.

In addition to the foregoing specific value this map is of general interest at present as showing the relation between the United States, its possessions, and the Far East and as including those areas around which present problems in the North Pacific Ocean are centered.

This map represents the acme of scientific precision combined with simple practical utility. It extends from New York and Panama to Singapore and Calcutta, from Alaska and Siberia to the Hawaiian Islands and includes a part of South America and a portion of Australia. Through its lateral center it extends over 180°, or more than half way around the earth.

The distinctive feature of the map is that these localities are here pictured in practically their true relation as to distances, areas, and comparative angular direction of coast line. It will thus serve to correct the erroneous impression that we have all received from the usual representation of this region on Mercator charts and maps which greatly exaggerate areas and distances toward the poles when compared with their equatorial equivalents, and to the eye present the general continental coast lines out of their proper angular relation to one another. This is not a criticism of the Mercator projection for use in navigation, but merely of its use for purposes for which it is not adapted. In fact, if the Mercator projection were transversed just as the polyconic has been, the result would be only slightly different.

The problem of representing any considerable portion of the ellipsoidal form of the earth on a plane surface is not readily dealt with, or, in other words, is intractable. Always some desirable features must be sacrificed in order to incorporate those of primary value to the problem or area at hand. In the present instance, the property of true scale along a great circle tangent to the forty-fifty parallel of north latitude at the central meridian of the map was chosen. This great circle is approximately the shortest distance between San Francisco and Manila, and in close proximity to it lie practically all the important points of interest, such as the Panama Canal, Mexico, our Pacific Coast, Alaska, the Philippine Islands, Japan, and the coast of China. This is accomplished through the use of the transverse polyconic projection, which is the regular polyconic or American projection turned from its normal vertical axis to a lateral great circle axis. This is an involved and laborious operation, but the resulting advantages are well worth while where areas of this nature are presented and accuracy is desired.

Both the vertical and lateral axes are straight lines, true to scale, and represent the shortest distance (great circle) between their extreme points. From these central lines the scale gradually expands toward the corners of the sheet where the maximum error occurs, thus quite a wide band of small scale error is preserved through the lateral center wherein lie the majority of the important cities, commercial areas and trade routes of this region.

This system of projection was devised by Ferdinand Hassler, who was the organizer and first superintendent of the oldest scientific government bureau, the U. S. Coast and Geodetic Survey. This projection was computed and constructed by C. H. Deetz, Cartographer, U. S. Coast and Geodetic Survey.

Photographic Forest Survey

The 15th Aerial Photo Section, located at Crissy Field, Presidio of San Francisco, California, made a photographic survey recently covering the district between Fort Bragg, California, Montague, Calif., and Mather Field, Sacramento, Calif. This survey is to furnish data regarding the value of the forest patrol operations during the past summer.

THE CHOICE OF A WING TUNNEL

Second Installment of a Series of Wind Tunnel Articles "The Universities and Aerodynamics"

By E. N. FALES and F. W. CALDWELL

(Continued from last week)

IN establishing a Wind Tunnel Laboratory we must choose between the various forms in which such a plant may be built. All Wind Tunnel Laboratories are not alike nor indeed will the results from one always check those from the others, but the exponent of each holds for his own type. It is therefore the purpose of this article to itemize the characteristics fundamental in precise wind tunnel work, and with these as standard, to analyze the features of each type; toward the end that choice may be made, according as particular facilities or needs shall stipulate.

Desirable Characteristics: The object of a wind tunnel is to produce the empirical data upon which the science of aeronautics depends. Hence a wind tunnel must first of all be able to produce reliable results. The degree to which this aim is attained, with reasonable facility and economy of operation, will be found dependent upon the characteristics analyzed in the list below.

First Cost: At the head of the list we are obliged to put first cost, and ease of construction; and to consider whether, other things being equal, we get precise results more cheaply with an N. P. L., an Eiffel or a Gottingen type tunnel. The question of cost is seriously affected by the power and the size of building; in general, a large or powerful tunnel costs more than a small tunnel, the building cost varying as the $(\text{diam})^3$ and power costs as the $(\text{velocity})^3$ and $(\text{diam})^2$.

Uniformity of Velocity in Cross-Section of the Air Stream: Since we are simulating ideal flight conditions, it is of high importance that each portion of the model under test shall receive the same air velocity. A good traverse of the cross-section is shown by the solid curve of Fig. 1; the dotted curve is for poor traverse, such for example as could be caused by air entering an N. P. L. tunnel at an angle. It is impossible to secure uniformity near the tunnel walls. Here there is energy loss known as skin friction, which we can best explain according to the theory that the air flow surrounds itself with cyclic formation analagous to smoke rings. These are like roller bearings, (albeit with much internal energy loss) for the translation of the main flow.

Freedom from Velocity Fluctuations: Gustiness in the tunnel is to be avoided. Gusts, like their larger prototype in terrestrial air flow, are an obscure phenomenon which are best attributed to pressure increments resulting from whirls. Their effect is especially marked when the flow is accelerated. To them we largely owe the capricious nature of all air flow. To realize this, one has but to witness a terrestrial waterspout or "twister" forming at the earth's surface where acceleration in upward rise occurs; or to observe the counterpart in a wind tunnel intake, by using suitable visualizing means. A small vortex gains energy rapidly as it enters the intake bell of a wind tunnel. Once created by irregularities in the path, or by internal causes such as spiral flow, it persists. It may be of local extent, with the result that when it meets the model under test its energy is released on a part, rather than uniformly on the whole model. That is, its effect cannot be balanced off against a symmetrical effect elsewhere in the stream.

Furthermore, our best means of determining velocity is by pressure record; there is a time lag between changes of velocity in the tunnel and manifestations thereof on the manometer, and in gusty conditions of high energy flow we find our balance readings out of step with the velocity head readings.

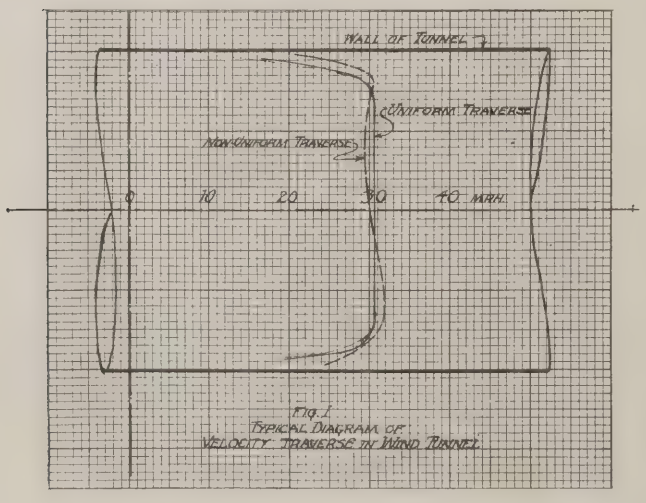


FIG. 1
TYPICAL DIAGRAM OF VELOCITY TRAVERSE IN WIND TUNNEL

Prevention rather than cure, is to be sought as regards "Gustiness"; and we here deal with what is perhaps the most important single item in attaining smooth air flow;—namely, the conditions of intake. The air prior to acceleration must be as nearly quiet as possible, and its path must be uniform and symmetrical. Various devices may be used to prevent the inception of whirls (the honeycomb, rectifier, straightener, etc.). Here also is the prime reason for using a large return flow area for the air, necessitating in the case of the N. P. L. type channels, a large building, toward the end that intake velocity may be low.

Freedom From R. P. M. Changes in the Fan: Change of fan speed, while slower and less harmful than changes due to

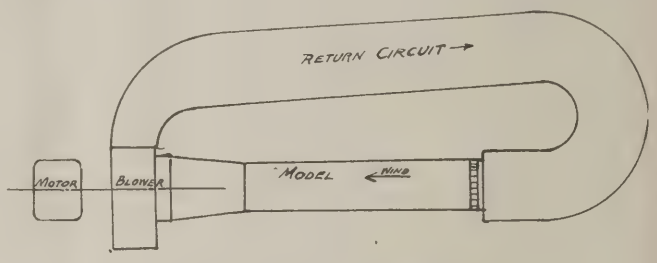


FIG. 2 PLAN VIEW OF TYPICAL CLOSED CIRCUIT WIND TUNNEL

gustiness, are nevertheless to be avoided; commercial ranges of ½% on the R. P. M. are about the limit, although new methods give promise of a lower figure. Any source power subject to variations of R. P. M. is to be avoided.

Rectilinear Air Flow: Air flow direction can now be measured to a small fraction of a degree; and in wind tunnels it is found to be not necessarily truly axial. Mr. Wright has observed that the angle may be one thing on starting up, and another later on after flow equilibrium in the room is acquired. Spiral flow is a form of non-rectilinear flow which must be avoided.

Convenience of Operation: Inasmuch as routine wind tunnel tests require a large number of successive readings, speed of operation is desirable. Labor-saving devices on the balance are particularly useful toward the end of reducing the personnel needed. Speed of reading the velocity pressure depends on the air flow conditions. Easy access is desirable for the purpose of installing, adjusting and removing the model.

Absence of Noise and Vibration: A wind tunnel involves much noise where the R. P. M. is high. In such case, conversation cannot be carried on and the discomfort is great. In common with aeroplane propellers, noise has been a subject of study; it can be decreased but hardly eliminated. Vibration depends upon the foundations used.

Economy of Power: This may be an important item, in large plants, or a minor item as in small plants. The present day tendency is towards large tunnels of good speed, and economy of power is important. The regenerative cone is the chief factor in economy; since this entails considerable

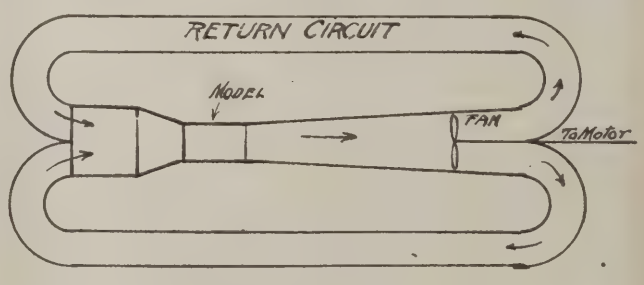
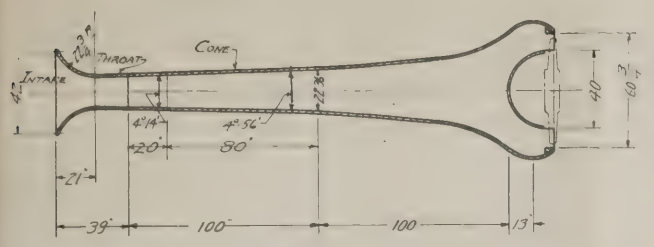


FIG. 3

PLAN VIEW OF TYPICAL DOUBLE RETURN CLOSED CIRCUIT WIND TUNNEL



OUTLINE DIAGRAM OF McCOOK FIELD VENTURI-TYPE WIND TUNNEL SHOWING CONE PROPORTIONS FIG. 4.

space, economy of power often means high cost of building.

Independence of Weather Conditions: The apparatus must not be subject to sudden changes of atmospheric pressure. So sensitive is air flow that an open door is sufficient for transfer of gust effect from outdoors into the tunnel; with the result that satisfactory results are hard to get. Outdoor tunnels therefore cannot be counted on for fine work more than two or three days per month, and while they may conceivably be attained in the future, we must await the development of improved automatic recording instruments.

Large Size of Blast and High Speed: The law of dynamic similarity makes it desirable to secure a product of speed and dimension as near as possible to the full scale values; although it is not practicable to reach the full scale value. Again, the high speed of propeller blades calls for high speed tunnels where propeller work is done. Large size of tunnel permits large models, which can be made more easily and tested more accurately than small ones. In general, large size is costly in building expense, large speed is costly in motor and electric current expense.

Space Required: The N. P. L. type tunnel requires comparatively large floor space, and high ceilings. An ideal housing would be formed as a cylinder with axis coincident with the tunnel; the return flow would then be truly symmetrical. In practice a desirable building has height substantially equal to width. The closed circuit tunnel can be installed in any space big enough to contain it.

Speed Range: While most routine tests in any tunnel are run at a given velocity, a wide range affords the advantage that we may study the speed effect on tests. Where alternating current motors are used to drive the fan, such range cannot well be had. Some methods of reading require a slight alteration of the speed sufficient to oscillate the balance for reading purposes.

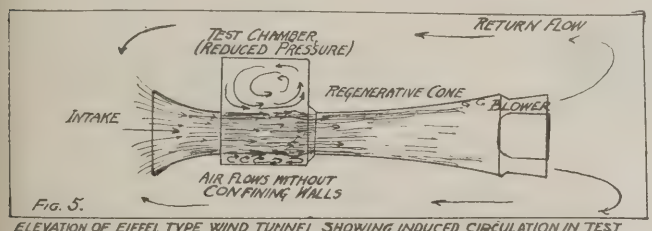


FIG. 5.

ELEVATION OF EIFFEL TYPE WIND TUNNEL, SHOWING INDUCED CIRCULATION IN TEST CHAMBER.

Suitability of Existing Tunnels for Attainment of Desirable Characteristics

Wind tunnel types fall under two classifications—(a) Closed Circuit and (b) Open Circuit. Fig. 2 is an example of the former. The closed circuit tunnel depicted was designed according to the principles of ventilating Engineering, in collaboration with a leading blower firm. The closed circuit has made its appeal largely on grounds borrowed from the older branches of engineering,—its primary idea being to avoid "discharge loss", to take the high speed flow after it has passed the model, and lead it by a return duct back to its point of original entry into the experimental chamber. Thus the kinetic energy was to be saved because the air at no point in its path was brought to rest.

As a matter of fact, purely from power consideration such a tunnel is inferior to the open circuit type, for in turning the corners or bends of the closed circuit, whirls and irregularities occur which absorb the energy otherwise to be salvaged, and the efficiency is very low. Furthermore, the whirls and irregularities resulting in such flow require special appliances and special care toward the end of eliminating undesirable effects in the air flow of the experimental chamber.

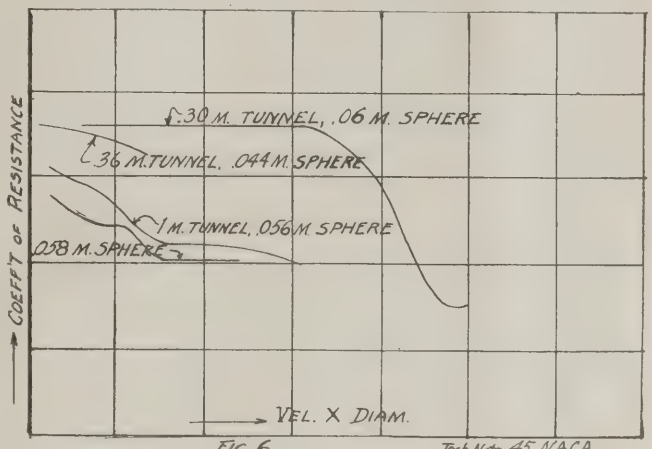


FIG. 6 DIAGRAM ILLUSTRATING EFFECT OF SIMILAR TESTS IN DIFFERENT WIND TUNNELS. Tech. Note. 45 N.A.C.A.

The New Gottingen Tunnel: Dr. Prandtl reports good success with his new closed circuit tunnel as regards uniformity of air flow. One advantage is that the return circuit is under the floor, thus saving much space. Another advantage is that the experimental portion has a gap, across which the air flows; and the flow is thus of easy access, and is not separated by

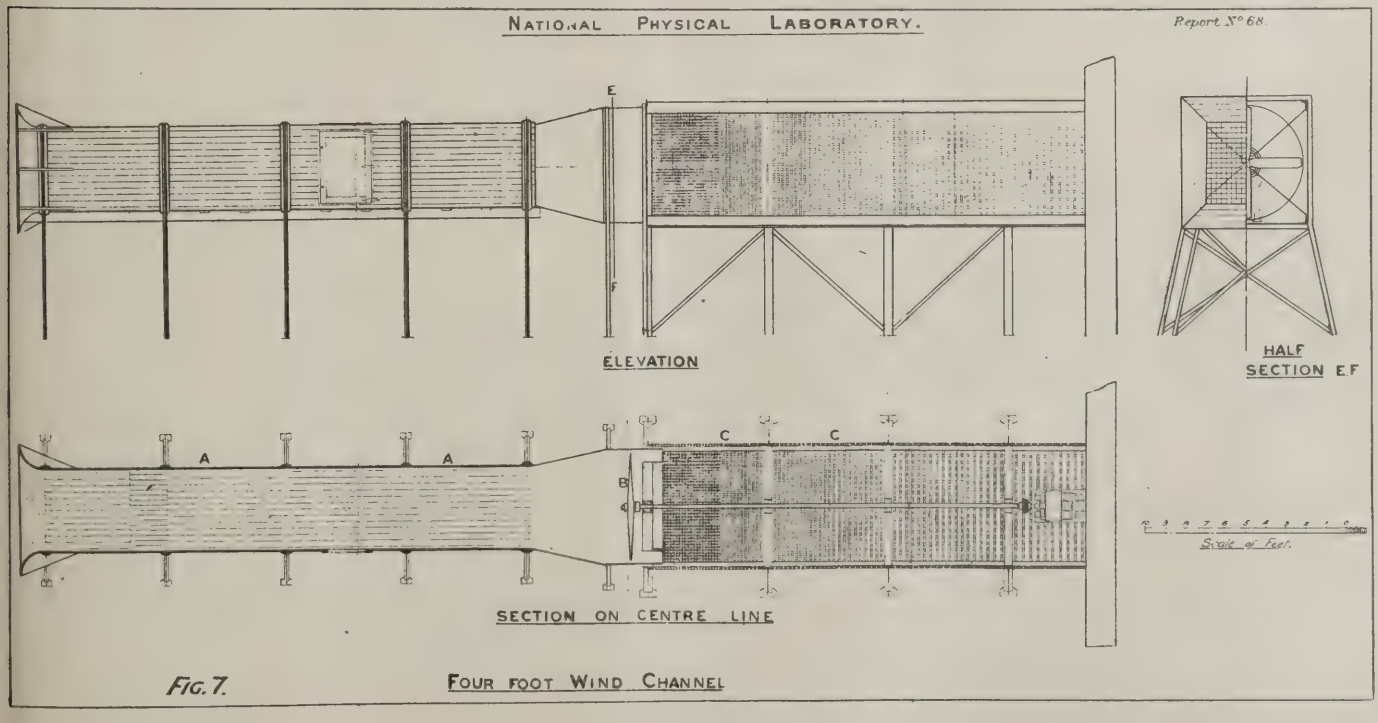


FIG. 7. FOUR FOOT WIND CHANNEL

doors, walls, or air-lock from the main laboratory. The efficiency, however, is not of the best—32%.

A more efficient form of closed circuit is that used by Orocco in Italy (Fig. 3). It has a symmetrical double return circuit, wherefore the air flow is easier to straighten out. Its efficiency is good (65%) because the air is decelerated in a regenerative cone before entering the return circuit.

The open circuit tunnel at present attains the highest known efficiency, *i. e.* 76% in the case of the McCook Field Wind Tunnel. (See Fig. 4.) Such a tunnel is analagous to the Venturi tube of the Hydraulic Engineer, where high velocity at the throat is attained without high velocity of discharge. After passing the throat the air stream slowly expands and decelerates in a suitable cone, until the greater part of the kinetic energy is converted into pressure, and velocity of discharge is low. Thence the air flows back through the wind tunnel building with velocity not at all formidable and reenters the intake. In effect it is a closed circuit wherein the return flow entirely surrounds the tunnel and has relatively great cross-sectional area.

Eiffel Tunnel: This type has been popular because it affords easy access to the air current. The tube has a gap surrounded by an airtight chamber of some considerable size. After once the operator enters this chamber through an air-lock, there are no further barriers to the introduction of models directly into the air stream. In Fig. (6) it is seen, however, that the gap causes secondary circulation inside the experimental chamber. This absorbs power and at high speed annoys the operator.

The N. P. L. (National Physical Laboratory) Type: This type has the advantage of good velocity traverse and smooth flow and is capable of high efficiency (although the N. P. L. tunnels themselves have low efficiency the regenerative cone principle not being adequately applied, they reach but 1/20th the efficiency attainable). A disadvantage of the N. P. L. type, which it shares in common with the Eiffel, is that for precise results a large building is required.

Rateau Tunnel: The Rateau type of tunnel may be mentioned sufficiently to note its defects. It consists of a jet of air blown from a nozzle into an open room; models are then tested in the jet. First of all, such a jet with difficulty can be smoothed out. Second, it has a longitudinal velocity gradient due to its deceleration. At the same time its cross-section enlarges and the streamline of such a jet has no directional uniformity.

Recommendation

In point of number the N. P. L. type leads, with the Eiffel a close second, and the closed circuit last (of the latter there exists one each in the United States, Germany and Italy). The closed circuit type may be eliminated from our consideration unless we are cramped for space, and even so, we ought to await further reports from Dr. Prandtl as regards the air flow steadiness of his new tunnel. The Eiffel type may be eliminated if we are willing to forego ease of access to the model, and are willing to shut down the fan every time we wish to touch the model.

There remains the N. P. L. type. Discounting the tendency of English speaking people to prefer this English-made tunnel, this type does nevertheless more nearly afford conditions of ideal air flow,—a straight line flow in a Venturi-like channel having continuous walls and symmetrical proportions. It is in the N. P. L. type of tunnel that we can, after suitable developments in the design, best realize the principles of air flow which are slowly gaining recognition as aeronautical study advances.

Recent analysis of air flow dynamics points to the importance of matters which in earlier days have escaped attention,—*i. e. slight* spin of the flowing stream, angular deviation, bad entrance conditions, etc. Those discrepancies which exist as between the results of one and another laboratory (exemplified in Fig. 6) are to be attributed to the character of the respective air flows, or to the methods of recording velocity pressures.

It is the character of the air flow, which determines the limiting precision of a wind tunnel; no case exists elsewhere in engineering where smooth flow must be so carefully sought as here. The chief problem in precision lies in recording velocity rather than in measuring the forces on the balance.

Thus, in considering types suitable for precise work, we must make uniformity and steadiness, *i. e.* smoothness of air flow the first requisite. Convenience, efficiency and even expense are subsidiary.

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut Street
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
J. SIDNEY OWENS, *2d Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. BAMBERGER
CHARLES L. HOWER
GEORGE S. IRELAND
FRANK A. L. LEAHY
JOHN W. PRATT
D. J. SPENCE, JR.
A. STANLEY TRUSCOTT

The October meeting of the Club was held at the rooms of the Club, 1026 Walnut street, Philadelphia. A large attendance of the members was noted. A dinner was tendered Mr. Joseph A. Steinmetz, president of the Club, who lately returned from an extensive European trip, during which he visited all the important air ports of France and England. Just previous to the business meeting of the Club the members were privileged to view the wonderful collection of air mail stamps which Mr. Steinmetz has been collecting for years. The collection dates back from the balloon letters which were sent out of Paris during the great siege of 1870 and included in the collection are stamps of the Hawker attempted Trans-Atlantic flight and the more successful one of Alcock-Brown. Undoubtedly it is one of the finest collections of air-mail stamps in the world.

An experiment which met wtih complete success attended the catapulted launching of a two-seated seaplane at the Philadelphia Navy Yard on October 31st. The plane was launched at a speed of 48 miles per hour and piloted by Captain H. C. Richardson, who was in command of the NC-3 when it started with the other NC's in their historical flight across the Atlantic. The catapult consists of a grooved track, fifty feet long, in which a cradle is fitted, with flanges on the side and bottom working in the groove.

The cradle bearing the plane is pulled from a dead stop to full speed by an endless cable which works on pulleys under the track. The cradle is stopped at the outer end by a bumper. When the cradle reaches the end of the track, the plane which it bears is hurled into the air. The development of the catapult to this point is the result of the bombing tests made this summer. By equipping the battleships with catapults, each vessel can, at the approach of a fleet of hostile planes, launch its own aircraft to fight off the enemy.

The Navy has requested Congress for ships with flush decks on which wheeled planes can make a landing, but points out that until these are constructed, battleships equipped with catapults can launch seaplanes, which will make their landing on the water and be hauled back to the deck.

Among those who witnessed the experiment were Captain Louis McCoy Nulton, Commandant at the Yard; Commander Westervelt, in charge of the Naval Aircraft Factory; and other high naval officials and scientists interested in the latest achievements in aeronautics.

During the latter part of November an all-metal seaplane was demonstrated at the Philadelphia Navy Yard, before a delegation representing the Manufacturers' Aircraft Association. The plane was flown by Lieutenant A. C. McFall, test pilot. After showing slight difficulty in rising it made an excellent performance in the air. The plane which is of the monoplane type, was built in Rotterdam. It has a span of nearly fifty-six feet and a wing area of five hundred and six feet. It weighs 4,750 pounds and will carry a load of 1,320. Its rated horsepower is one hundred and eighty-five, with a duration flight of three hours.

Under most hazardous flying conditions and heavy rain, "Father William Penn," in the person of Bert De Vere, flew to Washington on November 14th, to deliver to President Harding the news of the opening in Philadelphia of the campaign of the Welfare Federation for $4,000,000. Leaving Philadelphia from the field of the Aero Service Corporation at 73rd and Island Road, at 11:05 A. M., the plane landed at Bolling Field, Washington, at 2:45 in the afternoon.

"Penn' was sworn in as a special aeroplane mail messenger and the letters to President Harding had been stamped and cancelled in regulation manner. Prominent officials witnessed the "hop off." A return trip was made the day following and a message from President Harding endorsing the efforts of the Welfare Federation was brought back to Judge J. Willis Martin. The message was handed to "Penn" by the President in person. The plane left Bolling Field at 11:13 and arrived at the home field at 2:15 P. M.

W. H. SHEAHAN,
1st Vice-President.

THE CURTISS MODEL CD-12 400 H. P. AERONAUTICAL ENGINE

THE Curtiss Model CD-12 400 H. P. Engine has been developed from the geared engine of the same type during the last four years. The first engine of the above construction was built in the fall of 1917 and therefore the engine is now considered to have passed the experimental stage. It has been subjected to duration tests of various kinds during its development and has been developed into a serviceable and reliable engine without sacrificing its high performance and compactness.

The engine was designed primarily for a pursuit engine to give super-performance in high-speed aeroplanes. Every part was carefully designed to give maximum strength with the least weight. The engine was made as compact as possible without sacrificing accessibility, and the engine today is one of the most accessible aeroplane engines built. Exposure of working parts has been particularly avoided both to prevent wear and to stop oil leakage, which is objectionable.

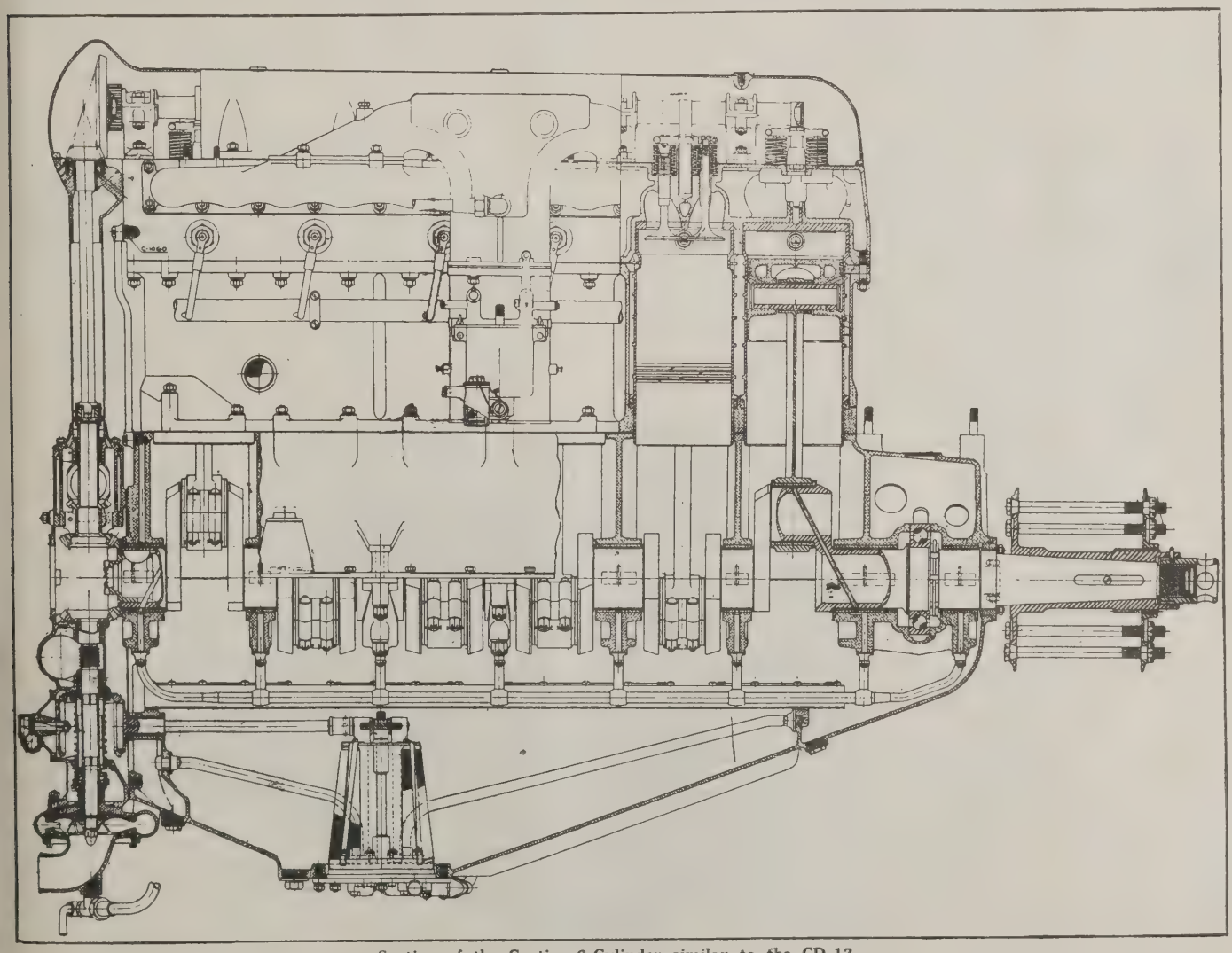
The engine runs remarkably clean and without vibration. A noticeable feature is the low temperature of the exhaust valves which run at a very dull red heat hardly visible to the eye, which is indicative of long life. The low gasoline and oil consumptions are unusual, coupled with long valve life and high engine speed. The low compression engine develops a B.M.E.P. of 137 lbs. per sq. in. gage using high test gasoline. Using doped fuel and high compression the engine develops as high as 143 lbs. per sq. in. gage B.M.E.P.

It is to be noted that with the entire cooling system, including water, the engine weighs only 2.27 lbs. per B.H.P. This figure was taken from the Curtiss Navy Racer installation, the aeroplane being the one which established a world's record of 176.7 M.P.H. on a closed circuit in the 1921 Pulitzer Trophy Race.

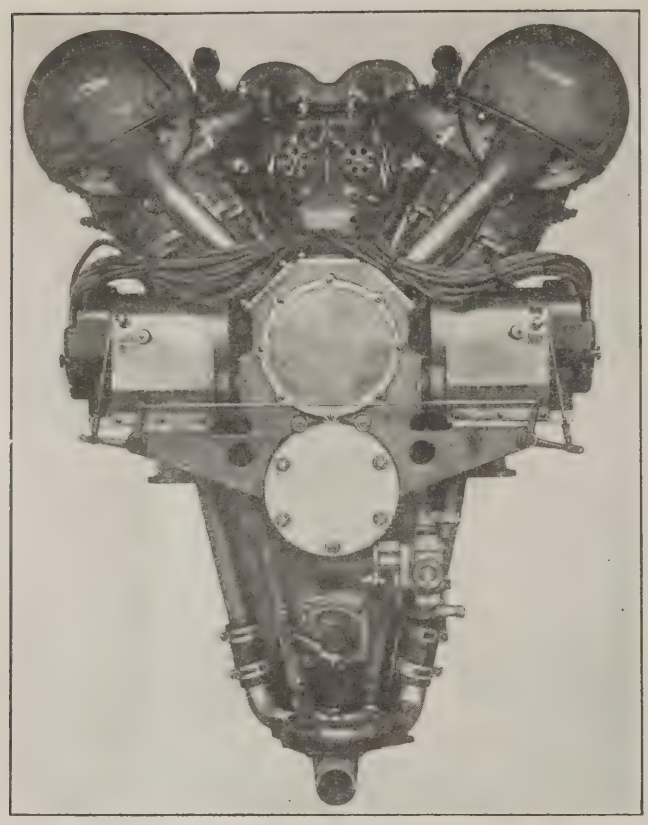
The Curtiss Model CD-12 Aircraft Engine of the 60° Vee Type consists of two rows of six cylinders having a bore of 4½" and stroke of 6". The engine has a total displacement of 1145 cu. in. The construction in general is of the aluminum cylinder type with inserted steel sleeves, each cylinder being equipped with two exhaust and two intake valves driven by overhead camshafts through bevel gears.

Cylinder Head Construction

The cylinder head proper consists of an aluminum casting formed in one piece to take six separate sleeves. These sleeves are made of high carbon steel of hydraulic forgings which are rough machined, heat treated and then finish machined before assembling in the cylinder head, with the exception of the final grinding of the bore. The sleeves are threaded at the closed end for a distance of 1½". At the lower end a gasket flange is formed and on the outside of the barrel several stiffening flanges are located approximately 1" apart. An integral stud is formed on the closed end of the sleeve which passes through the water jacket of the cylinder head after the sleeve has been screwed into the head. A nut on this stud draws the closed end of the sleeve into perfect contact with the aluminum cylinder head. After the sleeves are in place the valve holes are bored and seated, being properly spaced and aligned with the proper fixtures. Brass bushings are inserted through the side of the head for spark plugs. These bushings are tapered on the outside, to insure a tight joint. The water jacket consists of a one-piece aluminum casting which slips over the lower end of the six sleeves. In order to make a water tight joint at the lower end of this jacket a composition gasket material which resists the action of hot water, gasoline and oil, is used. The upper joint which is made between the jacket and the cylinder head with studs and nuts is made tight with a copper asbestos gasket. The lower end



Section of the Curtiss 6-Cylinder similar to the CD-12



End view Curtiss CD-12 Motor

of the water jacket is constructed with proper bosses for holding the complete cylinder head assembly to the crankcase, thereby forming a unit which is compact and accessible in case of overhauling or inspection.

Valve Mechanism

Each cylinder is equipped with four Tungsten steel tulip valves, two intake and two exhaust which are interchangeable. The clear opening is 1⅝" in diameter while the seat is 3/32" wide. These valves seat directly in the steel cylinder head. The valve guides are made of cast iron pressed into the aluminum cylinder head and need not be removed unless a replacement is desired. The camshafts are mounted on the top of the head on six aluminum brackets, the shafts running directly in the aluminum. There are separate intake and exhaust shafts, the intake shaft being *driven* from the exhaust shaft by means of spur gears. One cam operates two valves on each cylinder through a "tee" shaped tappet which works in a bushed hole in the cylinder head and which removes all side thrust from the valve stems, thereby insuring almost unlimited life to the valve guides themselves as well as allowing the valves to seat perfectly. The valves are adjusted by a screw in the ends of these "tee" tappets. Camshaft bearings are lubricated by pressure and the "tee" tappet bearings and valve guides by splash.

Crank-Shaft

The crank-shaft is of the conventional seven-bearing type, being made of 35-45 carbon chrome nickel steel. The drop forgings are heat treated and then finish machined. The crank-shaft has an outboard bearing beyond the propeller thrust bearing, thereby giving a very long support at the propeller end of the engine.

The crank pins are 2½ in. in diameter and 2⅛ in. long. The main bearings are all 3 in. in diameter and vary in length from 1 in. to 3 in. A bevel gear is bolted to the anti-propeller end of the crank-shaft to drive all accessories and camshafts. The propeller end of the crank-shaft carries a one to ten taper, fitted with a key for driving the propeller hub. The thrust bearing, which is mounted between No. 7 and No. 8 main bearings, consists of a deep-grooved radial annular bearing. This bearing takes the thrust in either direction.

Crank-Case

The upper half crank-case is cast from an aluminum alloy. The crank-shaft is supported on eight bearings, which are in single diaphragms, strongly ribbed to the case. Bearing caps are used to form the other half of the bearings, and are of I beam section. Each cap is fastened to the case with four studs fitted with castellated nuts. A large key way is cut in the cap and crank-case, to prevent the cap from shifting its position on the case when the engine is running.

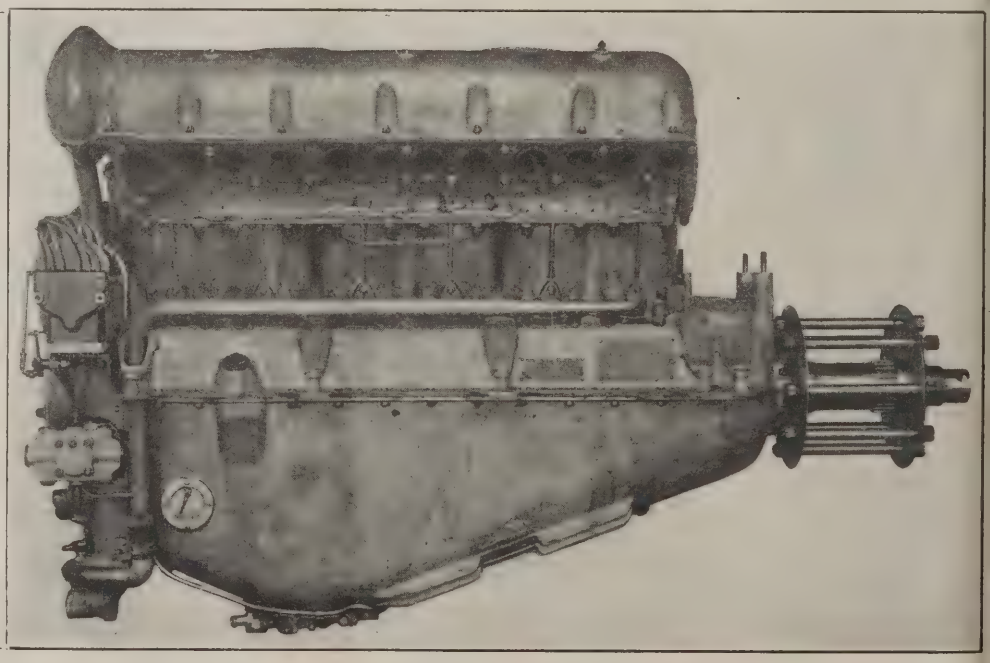
The bearings of the crank-case are fitted with bronze-backed, babbitt-lined bearing shells, which are held in place with countersunk head brass screws. These screws hold the bearings in place, and also provide a better contact between the shell and the aluminum crank-case. The bearings are bored carefully at assembly, maintaining the same clearance in all bearings.

Accessory Drive-Shaft

On the anti-propeller end of the engine is mounted a casting which carries all the shafts necessary for driving the oil pump, water pump, tachometer, electric starter, magnetos, generator, synchronizers and cam-shaft drive-shafts.

This assembly consists of one unit and can be removed as a unit.

All shafts and gears are put together with stub-toothed splines. The cam-shafts are driven through two drive-shafts through miter gears. This is made possible by the use of a short vertical shaft from the crank-shaft up to the point where lines from the exhaust cam-shafts form the proper angle for miter gears. The generator drive is taken off to the top of this vertical shaft. The synchronizer drives are taken from the two cam-shaft drive-shafts by forming bevel gears on these shafts at approximately their center. The tachometer drive is taken from a lower vertical shaft through bevel gears. This lower vertical shaft drives the water pump through a squared floating coupling. This vertical shaft also drives the oil pump through bevel gearing and helical gearing, which is mounted on the top of the oil pump. A pad is formed on the gear



Side view Curtiss CD-12, 400 H.P. Motor

case to take the Bijur starter which was developed for the Liberty engine. Magnetos are driven through flexible couplings and bevel gears from the upper vertical shaft. All the shafts in this gear case run at 1½ crank-shaft speed.

Pistons

The pistons are made of an aluminum alloy. They are of the trunk type, carefully ribbed under the head to obtain strength, and to dissipate heat. The ribs are arranged to allow even expansion from heat and to stiffen the pistons at the proper points.

There are three rings per piston, the two upper rings being ⅛ in. wide, and the lower ring 3/32 in. All rings are above the piston pin. An oil collecting groove is located directly below the lower ring with oil holes drilled through the piston walls, two of these leading to the piston pin.

The piston pin floats in the piston and connecting rod, and is held in place from lengthwise motion by means of snap rings made of piano wire.

Connecting Rods

The connecting rods are of I beam section and of the articulated type. The master rod is always assembled in the left-hand side of the engine when the crank-shaft is turning clockwise, so that the maximum pressure on the small rod will come in a line through its piston pin hole, wrist pin hole and the crank pin center. These rods are steel drop forgings, heat treated and finished all over. The upper bushing is "non gran" bronze. The lower bushing is bronze-backed babbitt, which is riveted in the rod and cap with brass rivets. The lower end of the small rod is forked and carries two "non gran" bronze bushings.

Lower Half Crank-Case

The lower half crank-case is flanged and bolted to the upper half crank-case at the center line of the crank-shaft. This case carries the oil pump drive-shaft and the oil reservoir which is separated from the crank chamber by a sheet aluminum partition.

The suction pumps are piped to each end of the case into small sumps, so that the crank-case cannot be flooded when the engine is out of normal position. An oil gauge of the cork float type with a dial on the outside of the crank-case is fitted.

Carburetion

The engine is fitted with two 52 mm. duplex Ball & Ball carburetors. Each Venturi tube feeds three cllinders through a fan-shaped manifold, which is open to the three cylinders and carburetor without partitions. The two carburetor air intakes are inter-connected with sheet aluminum conduits, which can be led to the outside of the fuselage in an areoplane.

Ignition

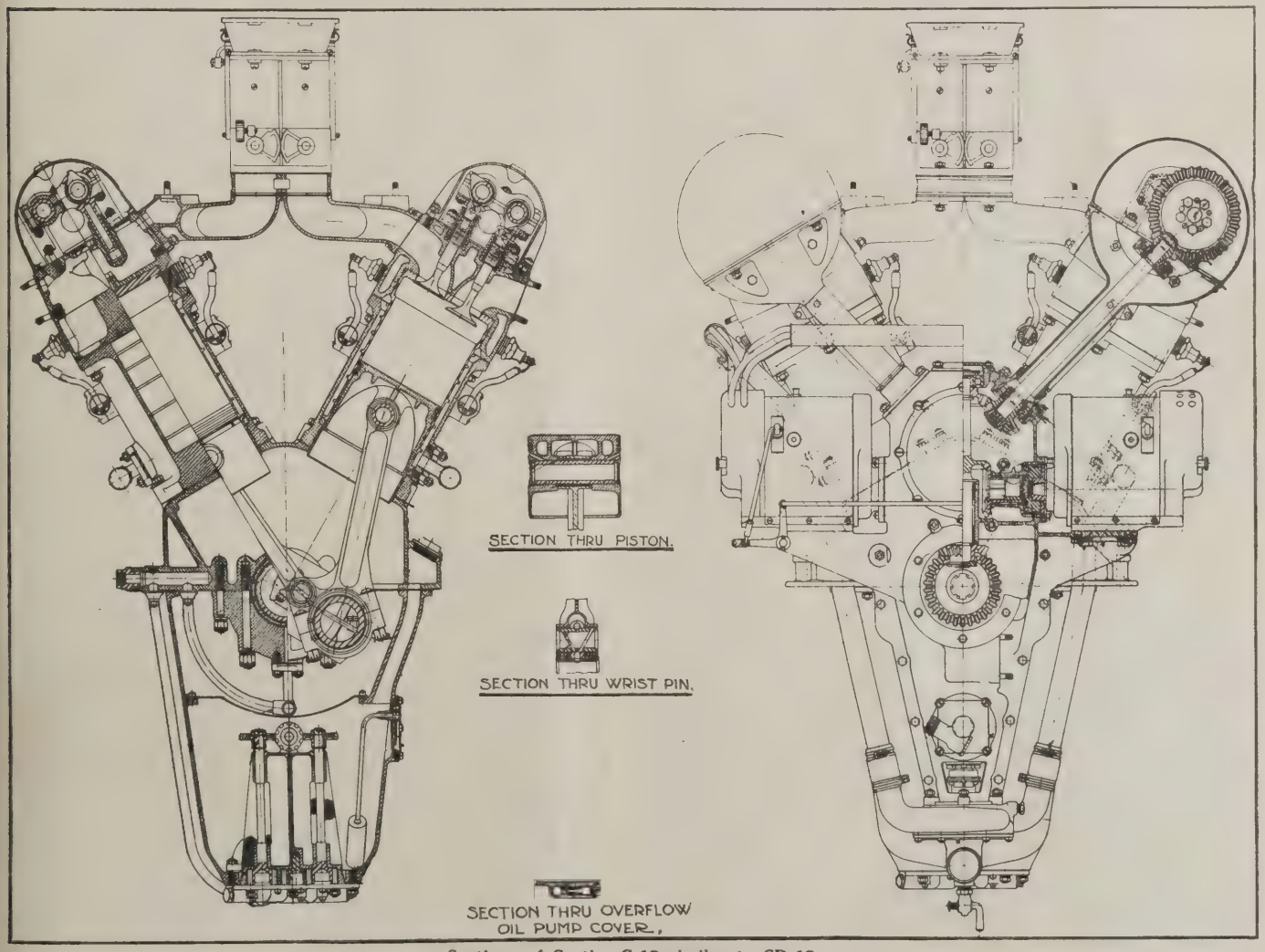
Ignition is furnished by two high-tension single-spark twelve-cyinder magnetos, driven through flexible couplings from the vertical shaft. There are two spark plugs per cylinder, which are connected to the magnetos by wires enclosed in aluminum cable tubes. The spark plugs are located at right angles to the center line of the block and diametrically opposite.

One magneto is wired to the exhaust plugs and the other to the intake plugs. These magnetos are equipped with a special switch which gives battery excitation for starting when the magnetos are fully retarded. The magnetos are the polar inductor type.

Cooling System

The cooling water is circulated by means of a centrifugal pump located at the lower end of the lower vertical shaft. This pump is of the double shrouded type, having an aluminum impeller with the intake on the lower side. The water is drawn from the radiators entering the pump through the cover, and after being discharged from the pump is directed to the lower end of the water jacket in each cylinder through tapered manifolds. The water surrounds the cylinder sleeves, passes through drilled holes of the heads, entering the cylinder heads, circulates around the ports and passes out at a point between the valves on each cylinder into a tapered manifold. From this manifold the water passes back to the cooling radiator.

The water pump is equipped with a deep-grooved radial bearing, which takes the thrust of the rotor caused by the suction of the water pump. The pump is equipped with a suitable stuffing gland to prevent leakage.



Sections of Curtiss C-12 similar to CD-12

Lubricating System

Lubrication is obtained by pressure feed from an oil pump located in the lower half crank-case, and driven as described in the section on accessory drives.

The gear pump forces the oil into a manifold which directs the oil into the bottom of each main bearing. The main journals in the crank-shaft are plugged and receive oil through three equally spaced holes in the journal. This oil then travels through a tube inserted from the journal to the crank pin in the connecting rod bearing. Tubes are also fitted in the articulated wrist pin to carry oil from the connecting rod bearings to the bearings in the small connecting rod which is forked at its lower end and carries two "non gran" bushings.

The cylinder walls and wrist pins are lubricated by splash The upper vertical shaft is fed by pressure from a duct leading from the first main bearing. Oil is piped from the anti-propeller end of the crank-case from the last-mentioned duct to the cam-shafts through the foot of the first cam-shaft bearing. Each cam-shaft is drilled at each bearing, so that oil may find its way into the inside of the hollow cam-shafts, allowing oil to lubricate each cam-shaft bearing under pressure. The cam-shaft bearings do not receive the full oil pressure, as the holes in the first crank-shaft main journal are so arranged that the cam-shafts receive index feeding twice per revolution of the crank-shaft. Oil from the cam-shaft bearings drains back into the front sump through the cam-shaft drive-shaft housings to the front gear case. This oil lubricates the ball bearings which carry the cam-shaft drive-shafts. It also lubricates the lower vertical shaft, which is carried in two bronze bushings surrounded by a pocket of oil. The oil from the connecting rod bearings and main bearings is drained into the front and rear sumps, to be drawn into the suction pumps through tubes connecting the pump with either end of the engine.

The suction pumps then force the oil into the oil reservoir below the oil pan partition. The pressure pump draws the oil through a truncated cone screen, thereby insuring clean oil to be forced into the main bearings.

A pressure regulating adjustment is provided on the cover of the oil pump. The cover of the oil pump is also arranged for connecting an oil cooler in series with the outlet of the suction pump.

Electric Starter

The engine is provided with a pad for mounting the anti-propeller and Bijur starter. This starter uses a twelve-volt battery. It is provided with a mechanism which releases whenever the engine "kicks back" when started.

Gasoline System

The gasoline system which is used in the high-speed ships equipped with the CD-12 engine is laid out as follows:

A double opposed gasoline pump, which is driven through worm gearing at approximately 1/10 of the vertical drive-shaft speed, and operates the pistons by means of a cam working in a slot in the connecting rod between the two pistons.

This arrangement provides a crank-case in the pump which has a constant volume, when the two pistons are reciprocating. Oil under pressure is supplied to this crank-case and a suitable relief valve is provided to maintain a predetermined pressure. This oil pressure seals the pistons against gasoline leakage and lubricates the piston walls. The pump forces gasoline to the carburetors, a small header tank being put in the line to dampen out pulsations. A relief valve is placed in the line to maintain a constant pressure to the carburetors. This relief valve overflows to the main tank.

A list of clearances and general specifications of the engine are given below:

Engine	*Curtiss CD-12 Low Comp.*	*Curtiss CD-12 High Comp.*
Rated H. P.	375	400
Normal R.P.M.	2000	2000
Brake H. P.	385	405
Weights		
Dry	700	700
With oil tank	700	700
With oil tank and water in system	790	790
With oil tank, water and radiator	922	922
Weights per B.H.P.		
Dry	1.82	1.75
With oil tank	1.82	1.73
With oil tank and water in system	2.06	1.95
With oil tank, water and radiator	2.40	2.27
Gasoline Consumption		
Lbs. per Hour	192.5	202.5
U. S. Gallons per Hour	32.1	33.7
Lbs. per B.H.P. per Hour	.50	.50
Oil Consumption		
Lbs. per Hour	3.00	3.24
U. S. Gallons per Hour	.39	.41
Lbs. per B.H.P. per Hour	.008	.008
With Temperatures Outlet	160	160
Overall Dimension		
Width	28¼	28¼
Length	56½	56½
Height	35	35

General Specifications

Bore—4½ inches.
Stroke—6 inches.
Compression Ratio—5.7 low; 6.1 high.
Oil Used—50% Baker's Castor, 50% Mobiloil A.
Capacity Oil Sump—5 U. S. Gallons.
Oil Pressure at 2000 R.P.M. should be 100 to 120 lbs. with the engine thoroughly warmed up.
Water Outlet—160° F.
Oil Temperature—140° F.
Spark Plugs—A. C. Aviation.

Summary of Clearances

Crankshaft to Main Bearings	.002 to .003
Connecting Rods to Crankpins	.002 to .003
Piston Ring Gap	.007 to .010
Piston Pin to Piston	.0000 to .0015
Piston Clearance	.010 to skirt
Piston Pin to Connecting Rod	.0000 to .0015
Piston Rings to Piston	.001 to .002
	(Keep near low limit.)
All gears	.002 to .004 backlash
Tappets (intake and exhaust)	.015
Magneto breaker points	.012
End play in front camshaft bearing	.004
End play in upper vertical shaft	.009
End play in lower vertical shaft	.009

(*Continued from page 267*)

will permit the use of a lower powered engine and consequently smaller, lighter aeroplane than would be possible with a high wing loading. The crux of the whole matter is that wing area is determined not by maximum landing speed but by performance and maneuverability requirements.

With very large bombers, especially those of the internally braced monoplane type, the ratio of wing area to flat-plate area is so much larger than is the case with small aeroplanes that wing area can be cut without sacrificing so much. With the monoplane type the structural advantage gained by a reduction in area together with the smaller wing spread makes a consideration of devices for increasing the lift on the wings worth while.

The application of the Handley-Page idea to commercial aviation shows somewhat more promise. The aeroplanes of commerce seldom fly over 7,000 ft. so that high ceiling in itself is of little value for them. High speed, however, is of great importance. Here again the limiting condition is the minimum rate of climb required for getting out of small landing fields. As remarked in the discussion of the effect of wing loading on military aeroplanes, the use of a low wing loading permits a lower powered engine than would be possible with a high wing loading. With a specified paying load and a minimum rate of climb, it is possible to select a smaller engine with lower fuel consumption, or with a given engine, to carry more paying load, when the wing loading is kept low. Nor is the high speed sacrificed appreciably.

It is clearly evident that Mr. Handley-Page has by no means proved the value of his slotted wing even if it is possible to work out the mechanical difficulties involved in its manipulation. The only real advantage gained is that of decreased landing speed with wing loadings kept close to their present values. Even this advantage is questionable since the landing speeds obtained with present design are reasonably satisfactory.

The above discussion does not apply in any way to the development of high lift wings of the usual type which gain their high lift through the nature of their profile.—B. C. B.

THE MANEUVERS OF GETTING OFF AND LANDING *

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART II.—"GETTING OFF"

I. Factors Which Particularly Influence "Getting Off"

(*Continued from page* 230)

(*f*) The paragraph dealing with slipstream effects was inevitably concerned with the control of the aeroplane. During the first phase of getting off, the pilot has to rely mainly on the action of the slipstream on the elevators, fin and rudder; or has to be extremely careful if he uses them unassisted by the slipstream. During the second phase he uses his control surfaces to maintain the aeroplane in the most suitable attitude to gather speed, in order to give them effectiveness; his skill in handling is here tested, as he may in addition have to encounter disturbing forces exterior to the forces normally encountered. During the third phase he handles the aeroplane so as to maintain it at or near its best climbing speed. This speed is frequently just so much greater than the lowest speed at which the aeroplane can fly as to give him a reasonable margin of control. If the air is very disturbed he may by selecting a slightly higher speed increase this margin, which should not, however, seriously affect his rate of climb; and as a disturbed state of the air is usually associated with a wind of some sort, his height over the edge of the aeroplane will not thereby be decreased. It is a definitely dangerous practice systematicallly to underestimate the margin of control referred to, as the pilot can never quite foresee the disturbing forces he may have to deal with.

Unless it is imperative that acceleration should be as rapid as possible, the pilot does not open his throttle or throttles with a rush, but usually occupies two or three seconds over it. This serves two purposes; firstly it lessens the risk of choking the engine and secondly it gives the wheels a chance of moving before the engine is exerting its maximum force tending to pull over the nose. Especially is this necessary where the elevator is only affected by the slipstream to a small extent. Once the aeroplane is fairly moving and the air forces have begun to act on the tail, the pilot, by lifting up the tail skid so as to make acceleration as rapid as possible, enters on the second phase. Due to the low speed, he sometimes has to push the control stick forward at this time. The aeroplane will then probably bounce owing to the inequalities of the ground. The most awkward time for a bounce to occur is at the commencement of the second phase, when the elevator is down fully to lift the tail, and there is no control left to put down the nose if the aeroplane is bounced up. But speed is gathered quickly, and further bouncing is less serious; in fact, the entry on the third phase is far more frequently the result of a bounce than of the pilot's volition. After this point, the pilot should not be worried by his elevator control if the engine runs well.

On the whole, the difficulties of laterial control, *i. e.*, rudder and ailerons, are more serious at low speeds than those of longitudinal control, for lateral control is achieved by a delicate co-ordination of two organs, not by a direct use of one. A bounce at the beginning of the second phase is not infrequently accompanied by the dropping of a wing, the results of which, if the aeroplane is not head to wing, may be serious. The yawing moment due to the ailerons has also to be reckoned with, for which the pilot has to be on the watch until he is well into the third phase.

In single-seaters and smaller two-seaters that have been fitted with balanced rudders and relatively small fins, a feature has been evident that must be clearly distinguished from the turning tendency due to the slipstream. There have been cases where although at all speeds in flight down to stalling speed the rudder has felt normal and not overbalanced, the aeroplane has swung violently and indiscriminately from side to side when getting off, and to maintain a straight course energetic paddling with the rudder has been necessary. This feature has been termed "woffling." No bite is felt on the rudder, and the behavior can be compared to the feel of an abnormally small rudder actually in flight. "Woffling" has, however, occurred in aeroplanes with quite large, and apparently under other conditions not overbalanced rudder. The rudder does not take charge of the pilot; the aeroplane simply swings; and in order to correct the swing, the pilot has, as it were, to anticipate the motion and use his rudder to the full lock. Watched from behind, the swinging of the aeroplane seems just out of phase with the rudder movements. An increase of fin area seems enough to damp out this tendency to "woffle."

(*g*) The general type of undercarriage to which pilots are accustomed is the plain "V" type, the shock absorbing properties of which are derived from elastic. There have been certain undercarriages of the "Oleo" type, and a few in which wheels have been employed in tandem.

One of the principal features with which the pilot appears to be concerned is the height of the undercarriage, which is mainly responsible for the angle of the aeroplane to the ground. No matter how safe is the aeroplane to handle in flight, it must be safe to handle in the first and second phases of getting off. Experience shows that the higher the undercarriage —with the consequent raising of the C.G. and thrust line— the more difficult is the aeroplane to handle. If the aeroplane tips over on its nose the impact is worse, and it is more likely to fling itself right over on to its back. Auxiliary forward wheels, if capable of sustaining the whole weight of the aeroplane, may of course do much to mitigate this; but the fact remains that the difficulties of getting off previously enumerated are aggravated by a high undercarriage. The aeroplane as a structure is simply top heavy; and with a high undercarriage this is unpleasantly impressed on the pilot.

When getting off on an aeroplane with a high undercarriage the tail may be lifted a certain amount and the aeroplane may feel quite normal; if, however, before the second phase is well advanced the tail is lifted more than this, it tends to come up very easily and the power of the elevator to maintain the aeroplane at a reasonable attitude feels unpleasantly limited. If the elevators are being pulled back during the second phase to correct perhaps a slight error of judgment in allowing the tail to come up too far, the pilot feels that he has not enough control left to raise the wheels clear of the ground when the suitable time arrives. The effects of bouncing under these conditions are also aggravated.

During the second phase the pilot is partly under the influence of air forces, and partly under that of the ground. He feels the bite of the wheels on the ground, and from this he estimates to a large extent the time to begin the third phase. The ordinary elastic spring undercarriages, while acting as fairly efficient shock absorbers, give a reflection of what is happening as the wheels run over the ground, which the pilot feels. The "Oleo" types, with more efficient shock absorbing properties, scarcely give the pilot any ground feel. In getting off, this is in some ways a disadvantage, though in the larger more sluggish aeroplanes that do not drop a wing suddenly, the effect on the pilot is admittedly less serious. The question of how much various pilots rely on the ground feel when getting off is however a difficult one to answer.

(*h*) It has been advanced that a low undercarriage makes it easier for the pilot in getting off. Unfortunately the chief means of arranging the wings at a large angle to the ground is the high undercarriage. Most aeroplanes, with the exception of those with abnormally low undercarriages, have their wings somewhere near the critical angle when sitting on the ground; in one or two the angle may be slightly greater, in the neighborhood of 17°. It does not appear that a large angle on the ground assists the pilot to get off, as he frequently raises his tail during the second phase so that the center line of the aeroplane is nearly parallel with the ground. It is when landing that the large angle to the ground is of assistance.

When, due to a low undercarriage, the lower planes are close to the ground, a tendency for a nose-diving couple to appear while getting off has been noticed. This nose-diving couple may be due to a cushioning effect. If the aeroplane is trimmed so as to be in balance near its normal climbing speed, during the first and second phases of getting off it feels nose heavy, and tends to keep its wheels on the ground too long. In other words the pilot has to pull it off the ground to rise into the air. On the other hand if the aeroplane is trimmed so as to be comfortable getting off, then it will feel tail heavy in flight.

Apart from this, the low position of the wings seems to make getting off more pleasant, and, if only to a small extent, to damp bouncing.

(*i*) The position of the pilot in the aeroplane and the contour of the fairing round and in front of his cockpit influence his handling in a marked way. A subconscious view of the wings stimulates his sense of lateral balance; while his sense of longitudinal balance is normally derived from some feature of the aeroplane such as a top longeron of the fuselage. He may be seated in such a position as to be denied one or both of these; and although in practice he soon accustoms himself to do without them, when available he always makes use of them. If, after flying an aeroplane with a more or less horizontal fairing in front of him, a pilot gets into one with the fairing

* Lecture delivered before the British Aeronautical Society.

sloping steeply down to the engine cowling or the nose, he certainly feels lost at first, and cannot gauge accurately the attitude in which he is getting off.

There are few pilots who, for pure controlling power, would not prefer to be situated close to the C.G. The pilot then feels that physically as well as mentally he is the hub of the machine which he controls. Curiously enough, it is more doubtful whether for getting off this is the case. During the first and second phases the feel of the controls is of less use than at other times, and the instruments are of practically no use; if the pilot is at a little distance from the C.G. the consequent accelerations on his body are an additional guide as to his attitude, which he can well dispense with, and of which during ordinary flight he finds it more pleasant to be free.

2. General Notes on "Getting Off."

During the maneuver of getting off, the influences discussed above are as a rule only felt subconsciously; the pilot is busy watching the ground, to which ultimately he refers all his actions. Though it is true that in night flying the pilot's sense of the ground is somewhat diffused, it is rare for him to take up an aeroplane at night on which he is not experienced by day.

When getting off, the pilot is really concerned with three things: his attitude, the horizontal component of his velocity relative to the ground, which he feels roughly as his air-speed, and the vertical component, which he feels as the rate he is leaving the ground. His sensory impressions are the chief clue to these three things; he refers his attitude to the plane of the ground and its perspective towards the horizon, the horizontal component to the ground moving past, the vertical component to the ground as it appears to drop away. During the third phase the feel of the controls, the feel of his seat, and the air-speed indicator are of some assistance. As the pilot accelerates in getting off, there is some mental lag in the progressive accommodation to new conditions, and he is liable to overestimate his speed, that is, he is at any moment travelling more slowly than he thinks; it will be seen that in landing the reverse is the case; he is therefore more liable to stall when getting off.

In Part I., para. (2), I divided the process of getting off into three phases. The most favorable attitude for the aeroplane during the first and second phases should be that of least resistance; the air drag is increasing, and as the wings lift more, the friction of the wheels on the ground is decreasing. Whether pilots do achieve the most favorable attitude by feel is an open question; at least they tend to keep the tail down on sticky ground when the ground friction is high. Pilots vary in their attitude during the first and second phases between keeping the tail skid nearly touching the ground and lifting it to such a height as will bring the fuselage parallel with the ground. Considering the angle that the wings are usually set to the fuselage, the latter attitude is never exceeded. On hard and uneven ground many pilots prefer to get off with the tail well down, as the aeroplane feels pleasanter when it is bumped about. This may be accounted for as follows. If the aeroplanes bounces on rough ground with the tail well up, the tendency when the wheels strike the ground is for the aeroplane to nose over, and the angle of incidence to be decreased, thus decreasing the total lift just at a time when the pilot wants it increased. If, on the other hand, the tail is down, a similar bump will increase the incidence and consequently the lift, which certainly makes the aeroplane oscillate less violently. Of course, there is always a risk of this being overdone and lateral trouble developing, but the unpleasantness does not seem so great as that in bouncing with the tail too much up. Again, if the pilot gets bumped up to a large angle of incidence, he may not have enough control to put the nose down gently; instead of this, the nose-diving couple comes into play and the nose drops too violently, the wheels again strike the ground, and an increasing kind of oscillation is set up. The pilot must exercise his discretion both ways, and good style is the result of a happy compromise.

The co-ordination of the rudder and ailerons has been referred to as worth the pilot's close study. The sort of difficulty which frequently arises is as follows. The pilot is in the second phase, and due either to an air disturbance or a bump in the ground, one wing is thrown up and the other is dropped. The pilot tries to pull up the wing by using his aileron, in which he may perhaps be successful. At the same time the aeroplane tends to yaw due to the effect of the ailerons at low speeds. This yaw he has to correct with his rudder; but if his rudder control is all but used up in counteracting the rapidly developing turning tendency (referred to in Part II., para. (1) (*d*) and the aeroplane is caused to yaw the same way as it is tending to be turned by the slipstream, the rudder may be inadequate to deal with the two effects added together.

It sometimes happens in flying that the pilot comes to the limit of his controlling powers before he has achieved what he wants; the only thing he can then do is to allow the aeroplane its own will and gently convert its motion into another maneuver, which is the next best to that he desires to achieve; it is absolutely no use trying to use the controls in the vain hope of achieving the impossible, for in doing so serious elements of danger at once appear. Two examples of this can be given.

Take the case referred to in getting off. One wing has dropped. The pilot dare not attempt to raise it due to the rudder being inadequate to cope with the yawing moment produced by the ailerons added to the turning tendency. He simply has to allow the wing to remain down, very near the ground, and get off on one wheel, converting the motion, if he can accelerate the aeroplane sufficiently to lift the wheel off the ground, into a gentle climbing turn. The dropped wing will then give the correct bank for the turn. He will now in a natural and flowing manner have converted a straight get-off into a get-off with a gentle climbing turn, although he had, as it were, to change his mind in the middle of the second phase.

Again, suppose the pilot has got off with a steep climbing turn in order to avoid some obstacle. He has to watch his flying qualities carefully because due to the turn he will be much nearer stalling point. Then, owing to a slight error of judgment, he finds the aeroplane partially stalled at about 200 feet from the ground. The controls begin to fail him. What is his only method of recovery? He must lose some of his precious height to regain a margin of speed and control, and he must lose it in the most economical way. He must let the aeroplane fall into a turn in continuation of the climbing turn, swinging round again towards his starting point, gently easing the nose down with as little control movement as possible. Were he to move any of the controls violently in this critical state he would stall, and the nose-diving couple would crash him nose on into the ground. The most frequent mistake is to try and straighten off the turn by moving the rudder violently against it and pushing the stick forward in an attempt to put the nose down. The pilot thinks that if he could get straight he would regain control. No idea is more fallacious and as soon as he attempts to move the rudder across he stalls with a violent sideslip, and gets completely out of control. Aeroplanes which exhibit weather-cock instability more especially have to be handled with care in climbing turns off the ground. If the pilot is trying to avoid obstacles, or maneuvering for a good position as early as possible should his engine fail, a climbing turn falls into the category of forced maneuvers.

The effect of wind has not hitherto been considered. If the pilot is not restricted in any other way, of course he gets off up wind. If, however, he has to surmount a serious obstacle in getting off up wind, and there is a clear run down wind, he may select to risk a less pleasant get-off down wind for the sake of the clear run. It requires much more skill to get off across wind than up or down wind, due both to the difficulties of the aileron and rudder control and the incapacity of the undercarriage to stand up to lateral loads. Again, if there is a breeze blowing at 100 feet from the ground, the wind gradient in the neighborhood of the ground seems usually quite steep, and luckily for the pilot the air within three of four feet of the ground is seldom disturbed. Especially does this appear to be so at night. If the pilot gets off up wind, the wind gradient helps him in the form of an additional insurance against stalling, because he gathers speed more quickly. Getting off down wind, it acts just as surely against him; therefore no pilot would think of getting off down more than a comparatively gentle wind, except on a relatively high-powered aeroplane.

Getting off across wind is a different matter. Again, it is only attempted with relatively high-powered or maneuverable aeroplanes. The great thing is to curtail the first and second phases in order even at the risk of stalling to get the aeroplane clear of the ground as soon as possible, and then to drop the wing that is towards the wind, sideslipping into it, to keep a straight course over the ground. In fact, if it is practicable, the wing should be dropped during the second phase, and the get-off effected on one wheel; for if the risk of being blown right over is to be eliminated, the wind must not be allowed to get under one wing. When getting off across wind, lightly-loaded aeroplanes are the more difficult to handle during the second phase, due to the more violent effect of the wind; heavily-loaded aeroplanes during the third phase, due to the higher stalling point, and the temptation of the pilot to get them off at too low a speed.

(*To be continued*)

NAVAL and MILITARY AERONAUTICS

General Patrick Visits Langley Field

General Mason Patrick, recently appointed Chief of Air Service, with Major Oscar Westover, Chief of Balloon and Airship Division, Major Mars and Lieut. Whitley, Adjutant, Bolling Field, went from Washington on October 18 to inspect the new airship Roma, recently purchased from the Italian Government by the United States. The General and party were passengers on the C-2. The C-2 left Aberdeen at 6.30 a. m. Took the General and party aboard at Bolling Field and left there at 8.01 a. m. She arrived at Langley Field at 12.30 p. m. The General had lunch with Lieut.-Col. Danforth, Commanding Officer of Langley Field, and after lunch, completed the inspection of the Roma, and leaving this station at 3.00 p. m. returned to Washington.

Army Air Service Types

The U. S. Army Air Service's classification of aeroplanes for military purposes has no less than fifteen different types considered as necessary for future operations, as follows:

Type	*Description*	*Type Symbol*
I	Single - seater Pursuit — water cooled engine	PW
II	Single-seater Pursuit for Night Attack—air or water cooled	PN
III	Single - seater Pursuit — Air cooled engine	PA
IV	Single-seater Pursuit for Ground Attack—air or water cooled	PG
V	Two - seater Pursuit — air or water cooled	TP
VI	Two or Multi-seater for Ground Attack—air or water cooled	GA
VII	Two-seater Infantry Liaison—air or water cooled	IL
VIII	Two-seater Night Observation —air or water cooled	NO
IX	Two or Multi-seater Army and Coast Artillery Observation and Surveillance—air or water cooled	AO
X	Two-seater Corps Observation—air or water cooled	CO
XI	Two or Multi-seater Day Bombardment—air or water cooled	DB
XII	Two or Multi-seater Night Bombardment, Short Distance—water cooled	NBS
XIII	Multi-seater Night Bombardment, Long distance—water cooled	NBL
XIV	Two - seater Training—Air cooled engine	TA
XV	Two - seater Training—Water cooled engine	TW

Carlstrom Field 100% Membership

Major Ralph Royce, Commanding Officer at Carlstrom Field, Arcadia, Fla., has sent to the Army and Navy Air Service Association headquarters, Star Building, Washington, D. C., thirty-one applications for membership, being 100 per cent membership at that field.

Major W. Jefferson Davis

W. Jefferson Davis, formerly major, has recently been appointed a member of the Aviation Committee of the American Bar Association. Major Davis went to Cincinnati to attend the recent convention and there took occasion to oppose the constitutional amendment which by some has been suggested as necessary.

Captain Mustin, U. S. N.

Capt. H. C. Mustin, U. S. N., has been relieved of the command of the Pacific Air Squadron to be assigned to the duty in the Navy Department as Assistant Chief of the Bureau of Aeronautics. He will succeed Commander W. J. Giles, U. S. N., who is due shortly for sea service. Captain Mustin is a pioneer in the Naval Air Force. While in command of the Pacific Air Squadrons, he has been very active in the development of aeronautics on the Pacific coast. One of his feats was to lead his squadron on a flight to the Canal Zone during the mobilization of the fleet last winter.

Army Gets Navy Dirigible for Bomb-Proving Purposes

A hangar for C-type airships has been erected for the Army Ordnance Department at Aberdeen Proving Ground, Maryland, and the airship C-2 has been sent there.

The C-type of ship has a gas capacity of 108,000 cubic feet and a useful lift in excess of 2,000 pounds at bombing altitudes. Bomb racks and rights are being installed in the ship for the dropping of bombs up to 1,000 pounds in weight.

The airship will be used for carrying an extensive tests of dropping various sorts of bombs from aircraft.

New Head Appointed for Research Bureau

Orders have been issued by the Navy Department designating Captain Ernest L. Bennett, now in command of the U. S. S. New York, as the next director of the naval experimental and research laboratory, which is rapidly approaching completion at Bellevue, just below Washington on the Potomac River. Captain Bennett will relieve Rear Admiral Wm. Strother Smith, U. S. N., retired, who developed the laboratory project, and who has from its inception labored unceasingly for the success of the scientific establishment. Captain Bennett will also relieve Admiral Smith of his other duties.

Helium in Navy Airships

Plans are in progress to make practical use of helium in U. S. Navy airships. An immediate start is to be made in experiment with gas at the naval air station, Hampton Roads, Va., where a non-rigid airship of the C class will be inflated. This experimentation is being conducted in connection with tests in regard to buoyancy, valve control, permeability of airship fabric, and methods of handling helium in connection with all types of lighter-than-air craft. This will be the first airship in the world to be so inflated, and it is expected that important data will be obtained, which it is hoped will be of considerable value in future employment of the gas. This is in accordance with the provisions laid down by the Aeronautical Board of the Army and Navy for the experimentation and development of lighter-than-air craft.

Changes in Personnel at Naval Air Station

Washington, Nov. 1.—Orders issued by the navy department today as follows: Lieutenant Commander Alston R. Simpson from Pensacola naval air station to San Diego naval air station; Lieutenant Guy D. Townsend from Pensacola naval air station to Atlantic fleet air squadrons; Lieutenant John D. Alvis, from U. S. S. Great Northern to Pensacola naval air station.

General Patrick Inspects McCook Field

For the last few years it has been customary, usually semi-annually, to hold an inspection of the Engineering Division at McCook Field for the purpose of formulating policies as to the carrying out of the experimental programs thereat. The inspecting party on the trip made on October 23rd represented the operating units of the Air Service and studied the equipment from the standpoint of its adaptability for use in the field. The party consisted of men qualified along the various lines of activities found in the field.

The inspection party was headed by General Mason M. Patrick, Chief of Air Service, and General William Mitchell, Assistant Chief of Air Service. General Patrick arrived at McCook Field by train, accompanied by Major Kilner, on October 24th, spending two days in the inspection of McCook Field and the Intermediate Depot at Wilbur Wright Field, returning to Washington on the evening of October 25th, while Major Kilner remained until October 27th. General Mitchell and the remainder of the party made the trip to Dayton and return by aeroplane. The remaining personnel of the party included Captain Walter R. Lawson, Captain Louis R. Knight, Lieut. Clayton Bissell, Lieut. Richard T. Aldworth and Lieut. Carl A. Cover, from Langley Field, and Captain Burdette S. Wright and Captain William C. Ocker from Washington. General Mitchell and Captain Wright, flying DeHavilands from Washington on October 23d, were met by Captain Ocker at Moundsville, who accompanied them to Dayton. Captain Lawson flew a Martin Bomber No. 1 to Dayton from Langley Field, carrying with him Captain Knight. It is interesting to note that this plane flown by Captain Lawson was the same plane used in the sinking of the *Ostfriesland* and the *Alabama* and in connection with the mining strike troubles at Mingo County, West Virginia, Lieutenants Bissell and Aldworth made the trip in DeHavilands, while Lieutenant Cover took the Thomas Morse pursuit through from Langley Field.

A thorough inspection of the field was was made by the party. The various types of pursuit, bombardment, attack and observation planes were flown and, in the case of pursuit and observation, the planes were maneuvered against each other by the various members of the party, in order that a complete study of the characteristics in the air could be made. In making this study over 130 flights were made during the week by General Mitchel and his staff.

General Patrick, General Mitchell and the staff were most enthusiastic about the work being done at McCook Field and the various types of planes, of which experimental models were present, or the preliminary drawings and characteristics worked out. The inspection was completed November 2nd.

FOREIGN NEWS

International Aviation Rally at Loreto, Italy

A report on the International Aviation Rally held at Loreto, Italy, on September 11th last, has just been received from the Military Attaché at Rome. Major James E. Chaney, Air Service, Assistant Military Attaché, attended this meet. The following program was carried out:

7:30 a. m.—Three flights of four aeroplanes each made formation flights over certain assigned sections of the Adriatic Coast to a distance of 30 kilometers inland. The flights were of bombardment, reconnaissance and pursuit planes, and to each flight was assigned a mission involving the principles of these specialties. The flight carrying out the most successful misison was awarded a handsome cup presented by the War and Navy Departments jointly.

10 a. m.—Benediction by the Cardinal of Loreto of the aeroplanes in flight over Loreto.

10:30—Religious ceremony.

12:30 p. m.—Official reception of all the pilots and authorities at the Royal Palace.

1:00 p. m.—Banquet in the Ryoal Palace.

4.00 p. m.—Presentation of insignia and prizes.

A concert, a lottery for the benefit of an orphan asylum for children of aviators killed in the war, fireworks and various other events occupied the rest of the afternoon and evening.

The Rally was attended by high officials of the Italian Government and of the Church, and by representatives of several foreign countries. A squadron of six Swiss aeroplanes was also present.

This Rally was in recognition of the adoption by Italian aviators and Catholic aviators abroad of the Madonna of Loreto as their patron Saint. The Italian Government has given official recognition to this patronage just as the Infantry, Artillery and Cavalry arms of the service each has its patron saint.

It may be interesting to know why the Madonna of Loreto was selected as the patron saint of aviators. In the cathedral of Loreto, a small village overlooking the Adriatic, near Ancona, is the House of the Virgin which was originally at Nazareth. Some centuries ago this house was moved, supposedly by miracle, from Nazareth to the Dalmatian coast. It remained there for some time, and about 600 years ago it was transferred, supposedly by a miracle, to its present position, which was then a laurel grove, and the present town gradually grew up around the place. This house is now in the cathedral and is protected and surrounded by a marble grating with numerous old sculptured figures representing the small house in the air during the various stages of its supposed flight to Loreto.

Air Service in Mesopotamia

In accordance with plans approved a year or more ago official steps, it is stated, are being taken towards replacing the greater part of the army of occupation in Mesopotamia by units of the Royal Air Force. This will not only tend to save the government many millions a year in expenditures for the army, but will afford a great object lesson in the value of aircraft in carrying out the almost purely police duties of an army of occupation.

R. A. F. in India

The Indian Group of the Royal Air Force is being reorganized, and will in future comprise four wings instead of two, although the number of squadrons will not be increased. The new distribution of units is as follows:

R. A. F. Headquarters, Ambala.

No. 1. Indian Wing: Headquarters, Peshawar; No. 20 Squadron, Kohat; No. 31 Squadron, Peshawar.

No. 2. Indian Wing: Headquarters R. A. F. School, and No. 28 Squadron, Ambala.

No. 3. Indian Wing (new formation): Headquarters and No. 5 Squadron, Quetta.

No. 4. Indian Wing (new formation): Headquarters, No. 27 Squadron, and No. 80 Squadron, Risalpur.

Aircraft Depot, Karachi. Aircraft Park, Lahore. The Aircraft factory at Lahore is no longer required and is to be disbanded.

The Air Officer Commander of the Indian Group is Air-Commodore T. I. Webb-Bowen, C. B., C. M. G. For operational purposes, the group is under the command of the Commander-in-Chief, India.

Danish Regulation

Denmark is engaged in completing a system of conventions regulating air traffic. An agreement with Norway was recently signed, and a conference between Danish and German delegates will begin at Copenhagen for the conclusion of a convention similar to that between Great Britain and Denmark. These arrangements will prove useful when aerial intercourse, which is at present quiescent, comes to be re-started, as it will then be no longer necessary for airmen to obtain a special permit to land on every occasion, as is now the case. Conventions on the same lines with Sweden and Finland are also being prepared.

Chinese Aerial Mail

An official Chinese circular has been issued regarding the Peking-Tsinan Aerial Postal Service which was inaugurated on July 1st and not August 1st as was officially stated previously. Regulations governing the carriage of mails or parcels are briefly as follows:

1. The Pekin-Tsinan Aerial Postal Service will carry mails and valuables. No passengers will be carried for the time being.
2. The service from Peking to Tsinan will be on Wednesday, Fridays, and Sundays, while from Tsinan to Peking the service will be on Tuesdays, Thursdays and Saturdays.
3. Machines will leave Peking on the scheduled days at 5 p. m., while they will start on their return trip at 10:30 a. m. The journey will be covered in two and a half hours.
4. The Peking terminal station will be Nanyuan temporarily, and that at Tsinan will be near Tuan Tin, Tsinan.
5. Besides the regular postage, mail or parcels carried by the service will pay aerial postage, the amount of which will be announced by the Chinese Post Office.
6. Aerial stamps will be on sale at all Post Offices.
7. Ordinary mails and parcels will be received at all Post Offices, but valuables must be taken for transportation to the Preparation Bureau of the Pekin-Shanghai Aerial Service Administration, Peking, or either the Peking or Tsinan Aerodrome.

Dirigible Construction in Spain

An arrangement has been reached between the Compania Trans-Atlantic and the Zeppelin Company of Germany for the construction in Spain of two rigid airships, each 250 meters long, 38.8 meters in diameter, and with a gas capacity of 180,000 cubic meters.

An air base is to be established in Spain (between Sevilla and Cadiz) where one shed will be built. A base has also been selected in the Argentine Republic where two sheds—one revolving—will be erected. The manufacture of the sheds will require an estimated time of two years. The sheds themselves can be built in much less time.

A smaller ship of the capacity of 50,000 cubic meters will be used for service between Spain and the Canary Islands, and for the training of pilots.

Japanese Aviation

It appears that Japan is sparing no efforts or expense to building up a great military and civil air force. From England representatives of Messrs. Short Brothers and from the Sopwith Aviation Company have gone to the East to superintend the building of British-designed machines. In addition, a number of R. A. F. officers have gone to Japan to organize the Japanese naval air service. Japan has enrolled some of the leading British designers and engineers. Shipbuilding firms have acquired foreign licenses for the manufacture of naval aircraft and aeronautical engines, and several European firms have established branches in Japan. In addition, military and naval deputations from the East have been for some time inspecting factories and machines in Great Britain, and orders for British, French and Italian machines have been placed with various firms.

Helicopter Flight

In an interesting article in the London Observer Major C. C. Turner comments on helicopter flight as follows:

Experiments with helicopters—machines with horizontal screws giving vertical ascension—are being carried on in many countries, and in Great Britain, the United States, and France are helped by the Government. The results of late have been far more encouraging to the inventors than were those obtained before the war, and there is no doubt that the great progress in aerodynamics due to aeroplane research, especially under the stimulus of the war, is helping the helicopterist.

References to helicopter experiments are often sensational. It is made to appear that vertical flight is what the whole aeronautical world is breathlessly awaiting; that it will revolutionize flying, since it would enable machines to land on flat roofs and to hover over an enemy. Yet upon consideration one seriously doubts whether even complete success with the helicopter would make much difference; although one would not go so far as to say that experiments are without scientific value.

Criticism of the helicopter usually takes the form of pointing out that, if the engine fail, descent will be as vertical as the ascent and a hundred times as fast. The criticism is met by the assurance that the helicopter whose engine fails may descend slowly, which was proved in England and elsewhere with large-scale models some years ago. Admittedly there are mechanical difficulties in ensuring the rotation in the right direction, under the pressure of the air, of the propellers in the event of engine stoppage; but the difficulties appear to have been overcome by certain experimenters.

Another difficulty is that of securing horizontal speed and direction. This has been solved, theoretically, by a slight inclination of the axis, so that the screws rotate in an inclined plane when, it is claimed, very great speed is attainable. The preservation of balance is another problem which, however, has in theory been solved in more than one way, always, however, by mechanism admittedly complicated. Practical proof has not yet been given; and one cannot but fear that this and other elements of the helicopter proposition will demand a toll of damaged machines and, perhaps, of life.

M. Damblanc, discussing the experiments at a meeting of the Royal Aeronautical Society, had to admit that a descent with engine stopped would be at the rate of about ten miles per hour; and this, of course, in vertical contact with the ground to a machine weighing half a ton or more, would mean serious risk of wrecking; it would certainly call for a very remarkable shock-absorbing contrivance, which would be very heavy. And, if under the influence of wind, the descent were aslant the difficulties would be increased.

None of the helicopterists can yet claim that balance could be so nicely preserved in the last 100 feet of descent, where the air is so often "uneven," as to make the landing perfect. Still more disturbing is the thought that the engine might fail at so low an altitude that the fall-checking action of the propeller could not take effect.

The aeroplane, on the other hand, lands on a gentle gradient, so that even high speed is, within limits, no danger; and wind makes it easier by reducing the ground speed.

On the whole proposition, including that of the conversion of power expended into useful work done, it would seem that the aeroplane must have the best of the argument. Perhaps the difference between the two may be likened to the difference between using wheels in mechanical traction and attempting imitation legs!

As regards performance, there remain some serious drawbacks to the helicopter. M. Damblanc, one of the foremost workers, has to admit that the utmost height attainable by his design would be about 5,000 feet, and that as that height was approached ascent would be extremely slow, and would call for the sacrifice of all impediments. If this, indeed, be the limit, the prospects before the helicopter, whether for war or for commerce, are gloomy. Of course, we must assume that, as in the aeroplane, the limit of to-day will be surpassed to-morrow. But any impotant development in power, yielding more thrust in proportion to weight, would benefit the aeroplane quite as much as it would the helicopter.

Of reported helicopter experiments may be mentioned those of Berliner and of Hewitt and Crocker in America; the combined aeroplane-helicopter of Pescara, the Spanish inventor, which ascended to 3½ feet the other day; Mr. Louis Brennan's machine in England; and the work of Mr. Ellehammer, the Danish aviator who flew an aeroplane as long ago as 1906. The first helicopterist to be injured was M. de Payer, who broke an arm last year, and who is said to have ascended to 400 feet the other day, his machine then being wrecked. Then there is the Petroczy helicopter, which in its first experiments has been held captive on a cable; and it is suggested that it might supersede the kite-balloon, being equally good for observation purposes without offering so big a target or requiring so much space or field equipment.

The aeroplane, meanwhile, is steadily being improved, especially by means of the new high-lift wings. And high-lift wings that could be varied during flight, especially in conjunction with propellers of variable pitch, would greatly increase the range of speed, enabling very fast machines to land slowly and in small spaces.



The Model Exhibition at Omaha

AMONG the model aeroplanes on exhibition during the International Aero Congress in Omaha, in the window of one of the city's largest stores, the Burgess-Nash, were the Loening Special, made by R. W. Wilmer; scale models of the Curtiss JN; the De Haviland 4; a gasoline engined model of the Continental Pusher Biplane constructed by A. H. Fetters of Omaha, and three models built by C. J. Fastje—the Curtiss 18-T Triplane, an A-frame racer and the compressed-air monoplane.

A good crowd was on hand at all times, both day and night, to view the exhibition of models.

The Fastje Triplane, shown in the illustration below, weighs only nine ounces. By shortening the motor-stick a couple of inches and making the propeller a little heavier, Mr. Fastje succeeded in getting the model to balance at about one-third of the way back on the middle plane.

Model Exhibition in Gothenburg, Sweden

The model department of AERIAL AGE has been invited to send exhibits to an exhibition which will be held in Gothenburg, Sweden. The notice having been received too late for reply, models could not be sent in time, as the event is scheduled for the last week in November.

Exhibits are to include scale models and flying models; drawings, sketches and photographs. The work is under the auspices of "Kungl. Svenska, Aeroklubben, 1 Gotenborg," Hotel Savoy, Gothenburg.

Model Used for Omaha Poster Design

The clever poster designed by Eyre Powell, and used to advertise the International Aero Congress in Omaha, November 3rd, depicts a Loening racing aeroplane. The plane it illustrates was actually a 30-inch scale reproduction of the Loening, made by Mr. R. Wilson Wilmer of Brooklyn. This model was described in the June 13th issue of AERIAL AGE, together with three photographic views. Its realistic appearance attracted the attention of the Omaha Congress management who arranged for its purchase for the poster, and it proved to be well adapted for the purpose.

The Effect of Staggering a Biplane

An investigation carried out at the Massachusetts Institute of Technology wind tunnel, of the aerodynamic effects of stagger was more complete than had been made before, and therefore of considerable value. This information was sought because staggered biplanes have certain advantages from the point of view of visibility.

The conclusions of this test, which was made with aluminum wings 3 inches by 18 inches, the upper having a U. S. A. 15 section and the lower an R. A. F. 15 section, show that it is advisable from the point of view of aerodynamic efficiency to use the highest possible degree of stagger. Moreover, a positive stagger greatly restricts the centre of pressure travel, thus simplifying the problem of stability.

Flight Association Will Use Wind Tunnel

A thirty-six inch wind tunnel, of the Eiffel type, now nearing completion, will be used by the Long Island Flight Association to test the lift and resistances of bird-wing sections, etc.

The tunnel is of the open chamber type which permits the use of larger models than other types in use. As far as known, this will be the first privately owned testing tunnel in the United States. Its use will place the L. I. F. A. members at a distinct advantage in gathering information useful for application on soaring and gliding apparatus.

The balance mechanism will vary slightly from the standard Eiffel type, though as accurate results are promised. Data adaptable to dynamics as well as soaring flight will be recorded. Actual bird-wings will be procured and prepared for tunnel tests the same as the usual model wings are tried out. As practical data on bird-wings is extremely limited, it is probable that greater attention will be given to this work, especially since several of the club members expect to build gliders and soaring machines.

Those concerned in the building of the tunnel are familiar with the requirements of such work, having been directly connected with model building and wind-tunnel testing according to the requirements of the U. S. Government. The accuracy of the tunnel will, upon completion, be calibrated by recording the results obtained from tests on standard wing sections of which the lift and drift values are already established. The wing-section to be used is one of the U. S. A. curves, and the model of it will be accurately to scale to within one ten-thousandth of an inch.

Power to generate the air currents will be supplied by a four-cylinder water-cooled gas engine of 25 horsepower. It will drive a four-bladed propeller of 5 feet 6 inches diameter and low pitch so that the air flow can be made variable between 5 and 30 miles an hour, which is sufficient to cover the speed ranges to be dealt with in actual flight computations.

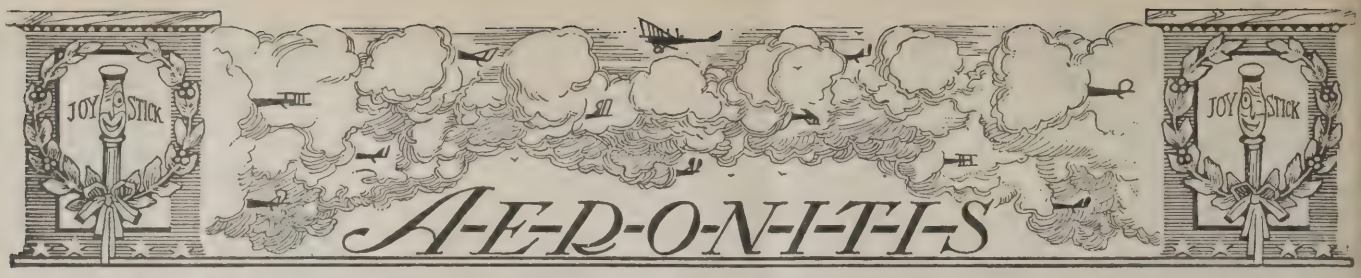
Mr. Charles B. Hayward, author of "Practical Aviation," in referring to the value of laboratory experiments, writes:

"There is yet so much to be learned regarding atmospheric laws and their influence upon flight that well-equipped experimental laboratories are indispensably necessary to the further progress of aviation. Just as the initial success of the Wright Brothers was the culmination of years of scientific research which demonstrated the worthlessness of many theories that for years previous had been regarded as well established, so the development of the future will be the result of consistently carried out lines of investigations rather than the outcome of chance discovery. The practical use of the aeroplane in the hands of such a large number of aviators will undoubtedly lead to improvement in construction and design, but for that thorough knowledge of the principles which is essential to increased efficiency and finality in design we must look to the scientist and his laboratory."

When the L. I. F. A. tunnel has been completed and tested, a report will be made dealing with its design and construction, and information upon experiments carried out by the club members will be published when the results are regarded to be of general public interest.



A Curtiss 18-T Triplane made from scale model drawings published in the Sept 5th Aerial Age



I have a story to tell you
  Who fly up in the air
If you have an OX5 motor on the prop
  Take it from me: Beware.
They back-fire, spit and sputter
  They never rev up high
If there's a fence in front of you,
  Just kiss yourself goodbye.

If it's a LeRhone you're depending on
  To carry you anywhere,
Just give her the gas and hope for the best
  And don't forget the air.
She'll sling oil, she'll cough and sputter,
  You'll think she is going to stop,
But feed her gas and air just right
  And she revs a wicked prop.

If you've a Hisso up in front
  You can pat yourself on the back
Because you can go wherever you start
  And be sure of getting back.
Don't warp her valves, "Handle with care,"
  Be leery of her stick,
She fires when you least expect it
  And she's got an awful kick.

But give me a smoking Liberty
  A-roaring in the wind,
Rocker arms leaping in the breeze,
  Twelve cylinders snarling grind.
Four hundred horsepower in your lap,
  A good ship 'neath your feet,
Sky above, earth far below,
  Say, boy, this life is sweet.

J. B. G.

Discouraging

Pat: Gee, this English language is sure awful. When I discover that if I am quick, I am fast; that if I was tied, I was fast, and if I spent too freely, I was fast, I was discouraged!

But when I came across this sentence: The first one won one prize, I was tempted to give up trying to learn English.—*Chicago News.*

Teacher: John, start a story for us.
John: I can't.
Teacher: Mary, you start it.
Mary: Once upon a time there was a boy named Ooglesby.
John: And Ooglesby died.

Gave Her Away

"Who gave the bride away?" asked Mrs. Jones of her daughter, who had just returned from a wedding.

"Her little brother," replied her daughter, "he stood up and yelled 'Good, Blanche, you've got him at last.'"—*Baltimore American.*

The Three Toads

A tree toad loved a she toad
  That lived up in a tree;
She was a three-toed tree toad,
  But a two-toed toad was he.

The two-toed tree toad tried to win
  The she toad's friendly nod;
For the two-toed tree toad loved the ground
  The three-toed tree toad trod.

But vainly the two-toed tree toad tried—
  He couldn't please her whim;
In her tree toad bower,
With her V-toed power,
  The she toad vetoed him.

—*Chicago Tribune.*

Customer: What is that Japanese idol worth?

Clerk (in a subdued tone): Worth about half a million; it's the proprietor.—*Junior League.*

Tommy: I like a girl who is reserved; don't you?

Jack: Yes, and especially if she is reserved for me.

May: These poor girls have to work fifteen hours a day. Isn't it a shame?

Grace: Why do you trade here, then?

May: They sell things so cheap, that's why.—*Flying Pat.*

Oldboy: What *has* become of the old-fashioned girl who used to say, "Ask father"?

Newguy: She now has a daughter who says, "Give it more gas, George, the old man is gaining on us."—*Mirror.*

Teacher: How is South America divided?

Bobby: By earthquakes.

Captain: Well, my boy, it's the old story I suppose—the fool of the family sent to sea?

New Middy: No sir, that's all altered since your time!—*Sailors' Magazine.*

Highlanders are the best ventilated people in the world. Now, John, can you deny that?

Old Lady: I see tips are forbidden according to that sign up there.

Waiter: Why, bless yer ma'am, so were apples in the Garden of Eden.—*Flying Pat.*

Sentry: Halt! Who goes there?
Colonel: Friend.
Sentry: Halt!
Colonel: You've hollered that twice and I answered. Why twice, man.
Sentry: Well, orders are that I am to yell, "Halt" three times and then fire.—*Farmer's Wife.*

Bob: Do handsome husbands pay?

Ian: Well, I guess they pay whether they're handsome or not. I'm not good looking, but I bought my wife a string of pearls and now I pay my first one alimony, too.—*Flying Pat.*

AN "IF" FOR STUDENTS——

(*With apologies to Mr. Rudyard Kipling*)

If you can study hard to get your lessons
Yet not forget that study isn't all;
If you can keep your faith, not make confession
That the chances for success seem awful small;
If you can "dig" and form your own impressions,
Dig hard, dig deep, dig broad;
If you can write and make it well worth reading,
Can master math and not say it's a fraud;
If you can study language—science,
Bar none and nevr say, "I can't;"
If you can enter into athletics
And help to win, though but by margin scant;
If you can foster greater interest,
Inspire vim, and in kndness never stint;
If you can play, but not let playtime
Cost too dear nor leave too great imprint;
If you can keep your standard high,
Help boost and be level to the core:
You are sure to be, or at least well nigh—
A student that the U will bow before.

AERIAL AGE WEEKLY

OL. 14. No. 13 DECEMBER 5, 1921 10 CENTS A COPY



Airscape of Graduate College, Princeton. Photographed by the Aero Service Corporation, Philadelphia

Aeroplane Carriers An Issue At Limitations Conference

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

MADE IN ITALY—USED THROUGHOUT THE WORLD

Ansaldo S. V. A. Aeroplanes

Reliability—Speed—Economy

TO

AMERICAN ANSALDO ACHIEVEMENTS

ADD

FIRST PLACE—LARSEN EFFICIENCY CONTEST:

Winner Larsen Trophy and $3,000 cash. Model Nine two place SVA flown by Capt. E. F. White, carrying a useful load of 1,161 pounds first, junkers second and third.

FIRST AND THIRD PLACES AMERICAN LEGION DERBY:

First, Winner Legion Trophy and $3,000 cash. Ansaldo Curtiss Balilla flown by Lloyd Bertaud.

Third, Model Nine SVA, flown by Capt. Earl F. White.

FOURTH PLACE PULITZER RACE, 1921

Ansaldo Curtiss Balilla.

Note: The SVA Model Nine which won the Larsen Trophy and placed in the Legion Derby is a stock model.

A Demonstration Will Convince You

AERO IMPORT CORPORATION

1819 BROADWAY NEW YORK

WRIGHT PATENTS LICENSEE

December 5, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 13

TABLE OF CONTENTS

Aeroplane Carriers an Issue at Limitations Conference 291
The Aircraft Problem 292
The News of the Week 292
The Aircraft Trade Review 294
An Investigation on the Effect of Raked Wing Tips 295
Establishment of Aviation Schools .. 295
Aneroid Investigations in Germany 297
Göttingen Wind Tunnel for Testing Aircraft Models 298
The Maneuvres of Getting Off and Landing 300
Naval and Military Aeronautics ... 303
Foreign News 304
Elementary Aeronautics and Model Notes 305
Aeronitis 306

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

Mr. Thomas says:

"I am taking out my fifth Lincoln Standard ship for a tour of the South this winter because I believe it will give me a bigger return dollar for dollar than any other plane on the market. I have flown Lincoln Standards for more than 1,000 hours without a forced landing. I consider the best demonstration of performance was brought out when I flew for three hours across country in a Speedster carrying 900 pounds dead weight other than fuel, and at one time on the trip I passed over mountains 9,000 feet high."



R. V. Thomas of Wyoming with his new Sportabout Lincoln Standard

(Write for descriptive folder)
NEBRASKA AIRCRAFT CORPORATION
Lincoln, Nebraska

Curtiss



WORLD'S RECORD

"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

CURTISS AEROPLANE & MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., December 5, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, DECEMBER 5, 1921 NO. 13

Aeroplane Carriers an Issue at Limitations Conference

AIRCRAFT took the place of submersibles November 19 as a principal topic of discussion among naval men who are here for the Conference for Limitation of Armament.

It was the new demand from Japan that she be placed on an equal footing with the United States and Great Britain—the other first-class naval powers—in the matter of aircraft carriers which prompted this shift in discussions from the murky depths where the submersibles lurk to ambush their prey to the blue air from which the warplanes launch their attacks.

It was predicted by naval men that when this new topic becomes a subject of conference discussion, as it necessarily must if Japan, as fully expected, should press her demand in earnest, it will introduce into the deliberations of the arms limitation conclave a topic involving what is, perhaps, the most vital principle underlying the present gathering of statesmen and military and naval experts,

Whether the bombing plane, which already, under tests conducted this summer by the American Army and Navy, has shown its destructive value in engagement with a capital ship, should be looked upon as a weapon of defensive or offensive character, would, according to naval men concerned in the deliberations of the conference, be a question calling for settlement in terms of precise definition. The question to be settled, in the opinion of naval men, is this: Is the aircraft carrier on par with the capital ship in destructive potentiality and is the limitation fixed in the American proposal, for that reason, to be as rigidly adhered to as the limitation relating to dreadnoughts and battle cruisers?

In the Hughes proposal the ratio governing future limitation in the tonnage of capital ships is carried right through, and in its practical effect, therefore, the aircraft carrier, though naturally classed as an auxiliary, is treated in the allotment of tonnage as though it were on a par with those big and powerfully armed vessels.

The Hughes proposal provides for an allowance in aircraft carriers of 80,000 tons each to the United States and Great Britain and 48,000 tons, or 60 per cent., to Japan. Japan feels that whatever allowance is given the two first named powers shall be allotted to her also.

American naval men declined to discuss the prospective demand of Japan, declaring it was a question that the conference must settle. The subject will bring another knotty problem before the subcommittee of naval experts, composed of some of the foremost men in the Admiralties of Great Britain, Japan and France and headed by Assistant Secretary of the Navy Roosevelt.

Among naval men in Washington for the conference opinion as to what ought to be done was divided. Many of the naval experts were reticent.

It was generally admitted, however, that aircraft carriers might be used as readily for offensive as defensive operations, the sole question involved being one of geography—whether they were used to ward off an attack in home waters or to carry abroad powerful war engines of the air for use in foreign waters.

"Of course," said one naval man, "an aircraft carrier having on board, say, twenty-five bombing planes and the necessary complement of projectiles, might be said to far exceed in potential capacity for destruction any capital ship afloat or projected at present. Aside from carrying capacity there is scarcely any limit to the size and destructive force of the projectiles such planes can launch from the air on a battle fleet or land fortifications. There is only this difference, that once their store of ammunition has been exhausted the planes are through, unless they can find a way of returning to the carrier and have it replenished. Experience has shown this to be a difficult and perilous operation. A battleship, on the other hand, has many rounds for heavy guns in her lockers."

One naval man of prominence expressed the opinion that the aircraft carrier was essentially to be regarded as a vehicle for offensive rather than defensive warfare. The American tests had shown that defensive operations could be carried on with more freedom and effect from a land base near the coast. The plane that sunk the *Ostfriesland,* it was pointed out in this connection, traveled 100 miles or more from her hopping off place to her target.

"If it is the dominant thought of the armament conference to make the navies of the future arms of defense rather than of offense, then limitation in the allotment of tonnage for aircraft carriers is quite as essential as limitation for capital ships of the large navies."

Japan at present is developing her air service with the aid of British experts. Of aircraft carriers she has at present in commission only one—a converted merchantman of some 9,500 tons. She has one prospective carrier of large tonnage already laid down, and two more are projected.

Great Britain during the war converted one of her fast cruisers of the *Furious* class—a thirty-five knot vessel—into a carrier of aircraft. Naval information shows that Britain has four aircraft carriers of the first line, with an aggregate tonnage of 67,200, and three of the second line aggregating 26,130 tons. Her building program includes three first-line and three second-line carriers of aerial craft.

The United States had planned two aircraft carriers of the

most modern and efficient type and of high speed, to cost $35,000,000 each, but Congress refused to appropriate the money. The best Congress would do was to give sufficient money for the refitting of the naval collier *Jupiter,* which has been renamed the *Langley,* and fitted for the carrying of aircraft to be used in naval operations. She is only 12,700 tons, has a speed of only fifteen knots and is pronounced by the naval experts entirely inadequate.

The Aircraft Problem

AS might have been expected, Admiral Sir Percy Scott, who pronounced the doom of the capital ship in 1914, has only one comment to make upon the American proposals to limit naval armaments: "The principal matter is whether we shall build more warships or not. Owing to the changed conditions of naval and aerial warfare, building battleships is a policy of the insane." In the British Admiralty's "Notes on Naval Policy," published eighteen months ago, it was said that the role of aircraft was "that of an auxiliary and not of a substitute for the capital ship," which was declared to be "the unit on which sea power is built up." Nevertheless: "It is possible to foresee tremendous developments in the air which may revolutionize eventually our present conception of sea warfar and sea strategy." This admission was made by the British Admiralty early in 1920.

A few months later the German dreadnought Ostfriesland, a spoil of war, was sunk by bombing army (not navy) aeroplanes off the Virginia Capes. Other surrendered German warships, including a cruiser, were also sent to the bottom. In a report of the tests General William Mitchell contended that "had the army air service been permitted to attack as it desired, none of the seacraft would have lasted ten minutes in serviceable condition. The first provisional air brigade could have put out of action the entire Atlantic Fleet in a single attack." Like Sir Percy Scott, General Mitchell fires off his convictions in broadsides. Both insist that the future of the navy will be in the air. Rear Admiral W. F. Fullam, retired, has said of the sinking of the battleship Alabama by army Martin bombers on Sept. 26, 1920: "It is childish to attempt to discount this result by saying the Alabama was an old ship. No modern dreadnought could have survived the attack."

The revolution of "our present conception of sea warfare and strategy" (to quote from the naval notes of the British Admiralty) having occurred, there was a lively interest in what would be found about aviation in the proposal of the United States for a limitation of naval armaments. It was very little, merely this: "The limitation of naval aircraft is not proposed." The following note was appended: "Owing to the fact that naval aircraft may be readily adapted from special types of commercial aircraft, it is not considered practicable to prescribe limits for naval warfare." But it was recommended that "the total tonnage of aeroplane carriers shall be as follows: United States, 80,000 tons; Great Britain, 80,000 tons; Japan, 48,000 tons." So an attempt was made to limit the number of planes that could be used as auxiliaries to the fleets of the three sea Powers.

If Sir Percy Scott and General William Mitchell are right about the menace of the bombing aeroplane, the nation that possessed a marked superiority in commercial aircraft over other nations could become, if it manufactured explosives on a large scale, the most formidable sea Power, provided it quickly improvised swift aeroplane carriers. The nation that neglected commercial aviation would do so at its peril. Probably more advanced in the use of aircraft for transportation than any other country is Germany, in spite of the inhibitions and safeguards of the Treaty of Versailles. Germany has many commercial air services today linking its cities. Already this year more than six thousand passengers have been carried on the regular routes. Visitors to Berlin may fly for two hours in the suburbs for 200 marks, or less than a dollar at the present rate of exchange. Few things are more common in Germany than aeroplanes, parked and in the sky. Many of these machines could be easily converted to military uses. Both France and England have a considerable superiority over the United States in commercial aviation. Japan lags in the competition, but aims to excel.

The United States has not only been slow to manufacture aeroplanes for commercial purposes, but has been backward in providing the navy with fast carriers. Obviously for its own interests the problem of limiting naval aircraft should be grappled with at the Washington conference. The alternative should be the rapid development of commercial aviation.—*N. Y. Times.*



THE NEWS OF THE WEEK



Flies 197.8 Miles an Hour In Navy Racer

Bert Acosta, piloting a Curtiss navy racer, at Mineola, November 22, broke the American speed record for aeroplanes by making an officially timed average speed of 184.8 miles an hour. The maximum attained on the flight, as checked by electric timing apparatus, was 197.8 miles an hour.

The test was officially observed by the Aero Club of America through Caleb Bragg, chairman of the contest committee. The timing device was operated by R. A. Leavell, of Chicago.

The flight was the first to be made under the rules of the Federation Internationale Aeronautique in this country since the war. Under these rules Acosta made eight flights over the measured course of one kilometer, four with the wind, and four against.

The previous American record was established last fall by Captain C. C. Moseley in the Army Air Service Verville-Packard biplane. This flight, however, was not made under the F. A. I. rules, but was officially set down as 186 miles an hour. Under the same system Acosta's time yesterday would have been 197.8 miles an hour.

The Roma in Test Flight

Newport News, Va.—The semi-rigid airship Roma, purchased from Italy by the United States, made her first test flights November 15, remaining in the air nearly four hours.

Officers at Langley Field, where the Roma was assembled, described the flight as most successful.

Baltimore to Have Big Aero Meet

A committee composed of members of the American Flying Club and the Maryland National Guard organizations has completed the plans for one of the largest aviation meets and exhibitions of aircraft ever held in the East. The date set is Sunday, December 4, and arrangements are being made to handle a record crowd. The meet will be held at the municipal flying field at Dundalk, which has been recently officially named Logan Field in honor of the late Lieut. "Pat" Logan of the Army Air Service, who was killed there during the aviation meet last year.

The committee in charge of the exhibit has been most fortunate and is assured of a large number of the latest military and commercial types of planes. It is expected that there will be twenty-five or thirty planes on the field for the meet. Brig. General William Mitchell of the Air Service, whose marvelous organization of bombers proved conclusively to the world that the most approved type of battleship heretofore considered practically impregnable could be sunk in a few minutes by bombs dropped from aeroplanes, is sending some of the officers who participated in the bombing and their planes to show Baltimore what a real modern bombing plane looks like. Besides the "bombers" the Air Service is planning to exhibit several other types of pursuit and speed planes.

The commercial exhibits will be second in no way to the military exhibits and will include everything from the tiny aerial runabouts to the large air liners with their closed-in cabins and large comfortable lounge chairs. These commercial planes represent the latest in the development of aerial navigation and include the best known European and American types.

In spite of the fact that a large number of the exhibits are coming from other cities, Baltimore will be well represented in the air by the 1st Observation Squadron of the Maryland National Guard. This organization, commanded by Capt. P. V. Burwell, is composed of one of the keenest groups of ex-service pilots in the country. It was through their spirit and enthusiasm and the untiring efforts of Major Geo. L. Jones that the squadron was organized and is today the only National Guard outfit in the country that actually flies. The Squadron has its own planes and will give exhibitions in formation flying, combats, bombing and acrobatic flying.

Both the officials of the Flying Club and the officers of the Guard want to make it plain that the meet is to be of an educational nature and not a circus affair, and for that reason admission to the field will be free. The general public little realizes the progress made in aviation during the past few years, both in this country and abroad, and of the two worlds the old seems to have surpassed us in the matter of efficient design. There will be at least two types of European planes at the exhibit capable of carrying six passengers with the same amount of power that was used during the war to carry one in a small scout

plane. This is just one indication of the early arrival of commercial aviation on a paying basis.

Turkey Goes by Plane to be Harding Dinner

Chicago.—Wearing an aviation helmet and goggles and clad in a black and gold sweater held on by a pink bow, "Supreme II," a thirty-nine-pound turkey, was placed on board an air mail plane at Checkerboard Field November 21 bound for Washington, where the bird will be killed to supply Thanksgiving Day dinner for President Harding.

The turkey is being presented to the President by the Harding Girls Club of Morris & Co., packers, and is the second to be sent to President Harding by the club. The girls knitted the turkey's sweater.

The departure of the turkey was accompanied by considerable pomp. A detachment of United States Marines accompanied it on the trip to the field, and the plane had to be considerably altered to make room for the big bird's crate.

Dr. Nichols Retires from M. I. T.

Cambridge.—Dr. Ernest Fox Nichols has resigned the presidency of the Massachusetts Institute of Technology and his resignation has been accepted by the executive committee of the corporation.

His decision resulted from the advice of his physicians that the illness which followed immediately upon his inauguration on June 8 last had resulted in "certain physical limitations, some of them probably permanent," which would make it unwise for him to assume the responsibilities of the position.

Deafness Partially Cured by Plane Ride

Spokane, Wash.—Total deafness following scarlet fever in childhood was partially cured by an aeroplane plunge in the case of Miss Esther Devlin, aged 20, of Spokane. The young woman was taken to an altitude of 13,000 feet in a U. S. Corporation machine, piloted by N. C. Mamer. The aeroplane was put into a nose dive and dropped 10,000 feet. For the first time in 13 years the young woman heard sounds. The whistling of the wind in the wings and guys was first audible, followed by the roar of the engine. Miss Devlin had first removed her helmet. On landing she was able to hear the pilot's voice. The cure was not complete, however, and another attempt will be made. Physicians asserted the girl's only hope for a cure was through shock. The full effect of the long plunge was not secured, for the reason, it was asserted, that Miss Devlin enjoyed the experience immensely and no contributing element of fright was developed.

California Club to Hold Aviation Ball

The Aero Club of Southern California has made arrangements for an aviation ball at the Ambassador Hotel, Los Angeles, on December 8, and the function promises to be one of the most important events of the social season in that city.

The officers of the club are as follows: S. M. Spalding, pres.-treas.; K. M. Turner, 1st vice-pres.; John H. Fisher, 2nd vice-pres.

The directors are S. M. Spalding, K. M. Turner, John H. Fisher, Frederic Whitney, John B. Miller, A. R. Peck, Albert Lee Stephens, J. A. Jevne, Lee A. Phillips.

Sunday School Aeroplane Race Across Continent

From Langley Field to San Francisco by aeroplane! And a race at that! That is what the members of the Langley Field Sunday School are taking part in with all the enthusiasm and daring of a race across the continent by their daddies in the Air Service.

Each class has chosen a type of aeroplane or airship in which it will undertake the long journey. The Roma, Thomas Morse, Lepere, Martin Bombers, Fokkers, and others are competing for first honors. Attendance of all members of a class at any one session counts an advance of one hundred miles, while for each member present a proportionate number of miles are achieved. A new member counts two hundred and fifty miles for the class securing such, while the highest average collection counts fifty miles advance. There are also forced landings. Such for example is the case when a scholar is late to school; his class has a forced landing and loses twenty-five miles. Serious forced landings also occur for bad behavior, the class having such a member being set back fifty miles for each offense.

But the contestants claim that their planes are in excellent flying condition and no forced landings are anticipated.

A generous prize will be awarded the winners, while each member of the winning class will receive a memento of the contest.

Flying Auto Demonstrated

Paris.—A flying automobile is the latest development in the French aero world.

A successful demonstration of an ordinary automobile with folding wings, two engines, one of ten horsepower for land going and the other of 300 horsepower for air travel, was held at Buc, Seine-et-Oise. The machine performed all the usual feats of an aeroplane and also of an automobile.

First Rarefied Air Dirigible to America

The world's first dirigible using rarefied air instead of dangerous explosive gases probably will become the property of an American syndicate, according to the Paris correspondent of the New York *Herald*, as soon as M. Bossi, representing the Zorzi Corporation of New York, arrives in New York to conclude details in behalf of the contractors of the dirigible, a French engineer named Vaujean and an Italian constructor named Garciulo.

M. Bossi sailed on board the *Orduna*. He is taking a small model which has aroused the keenest interest among aerial navigators. After ten years of experimenting Vaujean and Garciulo devised an apparatus consisting of three concentric envelopes in an aluminum compound all covered with heavy aeroplane textile and held in their places by steel wires. The power is obtained from four motors, each controlling a propeller. It is estimated that the dirigible can carry ninety passengers besides a crew and supplies sufficient for an eighteen-hour flight at a speed of seventy-five miles an hour.

Art and Aeronautics

We have pleasure in presenting the following information to our readers:

"I shall esteem it a great favor if you will be kind enough to publish this letter for me, as I wish to make known the fact that my artist friend, Mr. Robert Hunter, A. A. A. (Member of the American Art Ass'n of Paris and instructor in several leading art schools) had finally agreed to work mutually with me.

"Mr. Hunter is an American artist very famous in Europe (Paris especially) and this country, he is now back in New York and together we intend to bring art into the aviation business and aeronautical art into the homes and clubs of all persons who are enthusiastic about aviation, later into the home of 'outsiders,' incidentally forwarding interest in aeronautics. I venture to say that we are entering a virgin field. We are optimistically and sincerely hoping that we shall have support from everyone interested in aviation, from the individual to our largest aircraft manufacturers. Orders, no matter how large or small, will be promptly executed.

"It might not have occurred to many followers of aviation that aeronautical art can be introduced into their home to beautify it. Xmas and the New Year are near. We are willing to produce aeronautical art objects in the way of panels, screens, lighting effects and paintings of aviation scenes which will include portraiture in such cases, when necessary, on order. All these would make very acceptable holiday, Xmas, New Year or general gifts. What aviator would not be delighted to receive an oil painting of 'the type he flew on service' for an Xmas gift with him seated in the cockpit. With knowledge of the type he flew and a good photo of him we provide these.

"In opening up this new field *only works of quality* will leave our studio. Work will be done as ordered, i. e.—in oils, water colors, black and white or silhouette. I, as an aviator who has flown almost every type of service plane, promise that all our aeroplane paintings will be exact in all detail, absolutely to scale and be marked with Squadron markings if necessary. We invite correspondence regarding the above to me at 64 W. 70th St., New York City.

"(Signed) R. J. Smith."

To Use Air Trade As Basis of Quotas

Washington.—Specific new agencies of warfare are now being considered by subcommittees of the committee originally appointed by the Limitations Conference to deal with land armaments. The subjects of aircraft and gas are being considered by separate sub-committees.

It was stated November 25 that the committee considering aircraft was working on three general principles—quantity, character and use. On the first, it is understood the basis for determining each nation's quota in peace time will be the progress which commercial aviation has made in that country.

As for the second point, there are certain types of planes frankly built for use in war. Among these are planes of the JL-12 type, of all metal construction and armed with twenty-six machine guns for use against infantry and two against other aircraft.

It is said the third point must be looked upon from the viewpoint of the second, so that this will be governed by decisions regarding the character of planes to be built.

It is believed that both the American and British delegations will oppose any attempt to put a limit on the use of gas, because Germany has the largest gas plants in the world. In addition it is felt such limitation would handicap the technical industries.

A Good Example for Others to Follow

Evincing their interest in aeronautics, the Peerless Manufacturing Company of Norristown, Pa., made an official request for information from the Army Air Service on the markings for Norristown, stating that they will be only too glad to place these markings on the roofs of their buildings.

The AIRCRAFT TRADE REVIEW

The Truth About Commercial Aviation

There has been on the topic of aerial transportation so much false optimism on one hand and so much needless pessimism on the other that the average person is somewhat bewildered as to whether aviation is coming or going.

A progress report is needed on the status of commercial aviation, but this report to carry weight must be by a competent authority.

Engineering might be called the silent profession from the reticence with which its members conduct themselves in the discussion of topics of public interest. When engineers speak, therefore, it may generally be assumed that the opinions put forth are derived from a careful study of actual figures and facts.

The Society of Automotive Engineers, whose membership of 5,000 is composed of many of the foremost engineers, and which includes in its ranks a large number of aircraft designers, will hold a series of meetings through its Sections in several cities during the next month at which various speakers will tell what has actually been done both here and in Europe in the way of commercial aviation. Authoritative figures will be given showing the number of planes now in operation, the number of miles flown during the past year, the percentage of successful flights and the number of accidents to planes attending to business as contrasted with the much greater loss of life and limb caused by spectacular stunting or through the use of imperfectly designed machines or the operation of planes by insufficiently trained pilots.

The cost of aerial transport per passenger-mile and per ton-mile will be given. These figures will be obtained from flights that have actually been made on regular schedules both here and abroad.

Reports indicate that the machines of one foreign manufacturer during the past summer made 693 out of 725 trips scheduled; over 95 per cent. More than 160,000 miles was flown with no accidents whatever to cargo or passengers.

The annual report of our own Air Mail Service involves a much greater mileage. Of 7,659 trips planned, 7,081 were perfectly completed, or 85 per cent. Nearly half of the flights were made under bad weather conditions. A million and a half miles was flown and about 45,000,000 letters were carried.

After recounting what has been done to date, those scheduled to give the talks at the various meetings will discuss what problems are still to be solved. Subjects that will receive attention in this connection are airways, landing-fields, ground organization, legal aspects, radio and meteorological service and the relation of civil aviation to national defense. In connection with this last subject moving pictures will be shown of the recent aerial bombing operations against the surrendered German battleships. These pictures have not previously been shown publicly.

Those who will take part in this national program include J. G. Vincent, conspicuously identified with the Liberty engine; representatives of the Army and Navy Air Services; Glenn L. Martin, one of the pioneers in aviation; Ralph Upson, balloon expert, and Assistant Postmaster General Shaughnessy, who will give real information about the Air Mail Service.

The following dates have been fixed definitely:

St. Louis, December 1; Indianapolis, December 6; Worcester, Mass., December 9; New York City, December 15; Cleveland, December 16; Philadelphia, December 22.

Other meetings will be held during the month at Cincinnati, San Francisco, Buffalo and Detroit.

Six Big Factors In Flying Safely

There are engaged in commercial flying in the United States about 1,200 aircraft, according to a report prepared for the Department of Commerce by the Manufacturers' Aircraft Association. This report is based on the most trustworthy information obtainable, and a conservative estimate places the mileage flown by these commercial machines in the first six months of the present year at 3,250,000 miles, and in that period there were forty serious accidents in civil flying, the computation not including accidents to Government-owned machines, resulting in the death of fourteen persons and more or less serious injury to fifty-two others. In eighteen of the accidents there were no casualties, the fourteen deaths being charged to ten accidents and the fifty-two injuries to forty accidents.

The report as made public by the Information Group of the United States Army Air Service enumerates the requisites for safe flying as six in number. They are:

1. A machine sound aerodynamically and structurally.
2. An engine of sufficient power.
3. A competent, conservative pilot and navigator.
4. Air ports and emergency landing fields sufficiently close together to insure gliding to safety.
5. Nation-wide weather forecasts specialized and adapted to the needs of fliers.
6. National air-route charts.

"Each of the forty accidents," says the report, "was caused by deficiency in one or more of the above elements. Seventeen were attributed to the pilot, perhaps through carelessness, perhaps incompetence, perhaps bad judgment, combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class machine. Therefore, at the very top of the list of Government needs is placed the examination and licensing of pilots.

"During the war more than 17,000 young men were trained to fly. The art of flying cannot be retained perpetually without regular examination. Ten attained a high degree of competency without regular examination. Ten accidents of those given are attributed to inadequate landing fields or to the total lack of landing facilities. During the war the Army and the Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the air mail, municipalities and private enterprise, but the United States is today woefully lacking in air ports for even the 1,200 craft in operation.

"A survey made by the Manufacturers' Aircraft Association discloses that in the United States and its possessions there are only 271 land and water air terminals, many of them concentrated in certain localities. Of the 271 listed air ports, 145 are controlled by municipalities, 69 are privately owned and the others are a part of the Army and Navy Air Service and the air mail.

"While only two accidents are attributed to the lack of weather reports and two to the lack of clearly defined routes or limitations in traveling between or over cities, it is certain that aerial transport cannot develop until these factors are met. As an illustration, two of the worst accidents in our flying history are attributed to these causes. As one was naval and the other military, they cannot be included in the civil table, although in their results they were as harmful to civil flying prospects as though they had occurred to private individuals.

"Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. But of the forty accidents, eleven may be attributed to faults which proper inspection would have revealed—three concerning the plane, six the engine and two an accessory. In many instances it is found that the engine is blamed when realy it is an accessory that is at fault. An analysis of the Pulitzer race last year proved this, When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that any one can take any sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons below.

"Eight of the forty accidents occurred during stunting. In these eight accidents seven persons were killed and twenty-six injured—exactly 50 per cent. of the total. In other words, stunt flying in unrestricted areas was responsible for as many casualties as all other elements combined. While stunt flying is necessary to testing and essential to warfare—and it is believed advisable that all pilots know how to stunt, so that in case of an emergency, when only a stunt will save their craft, they will be able to act quickly, with understanding and without fear—the habit of stunting for thrill is dangerous, fatal in many instances and always harmful to civil flying. A governmental system of control limiting stunting to certain areas will meet this unfortunate menace to aeronautics.

"Two accidents were reported through carelessness on the field. In one notable instance the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. Only Federal rules, rigidly enforced, will meet this situation.

"Finally, five accidents are attributed to 'unknown' causes. The hope of preventing accidents depends on learning—then correcting—the cause of each. It is evident Government authority is required to obtain information in such cases."

AN INVESTIGATION ON THE EFFECT OF RAKED WING TIPS

By F. H. NORTON

Langley Memorial Aeronautical Laboratory

Summary

This investigation was carried out by request of the United States Air Service in the wind tunnel of the Massachusetts Institute of Technology. The results are here published by the National Advisory Committee for Aeronautics as it is thought that they may be of general interest. Wings of the R. A. F. 6 section are tested with various angles of rake, and it is found that although rake has very little effect, a positive or negative rake of 30° is the best.

Introduction

There has been very little work done on the careful investigation of wing tip forms. For this reason the present test was carried out to investigate the influence of rake when the aspect ratio is held constant. The angles of rake tested were 0° ± 20° ± 40°. A greater angle of rake than this would be structurally impractical. Only lift and drag runs were made.

An investigation of rounded wing tips has been made by the British Advisory Committee (T.477) and some work along this line has been done by Eiffel.

Methods

A short section of an R.A.F. 6 wing was fastened to the crank spindle of the N. P. L. balance and the various tip sections (Fig. 1) were pinned onto the ends of it. Due to the use of the crank spindle the drag readings are too low, but as only comparative values were desired no corrections were made.

Precision

As the differences between the various rakes were small, each set of wing tips was set and run three separate times, and the mean values taken. The precision is everywhere better than one per cent.

Results

The lift, drag and L/D are plotted in Figs, 2, 3 and 4, for various angles of rake. It is evident that the efficiency increases slightly with rake up to about 30° and then decreases, while the lift increases rather rapidly at large positive rakes. The increase in L/D at 4° incidence by using a 30° rake, as compared with a square tip, is about 7%.

Conclusions

It may be concluded that the effect of rake on the lift and drag are so small that considerations of strength and aileron efficiency should govern the wing tip form.

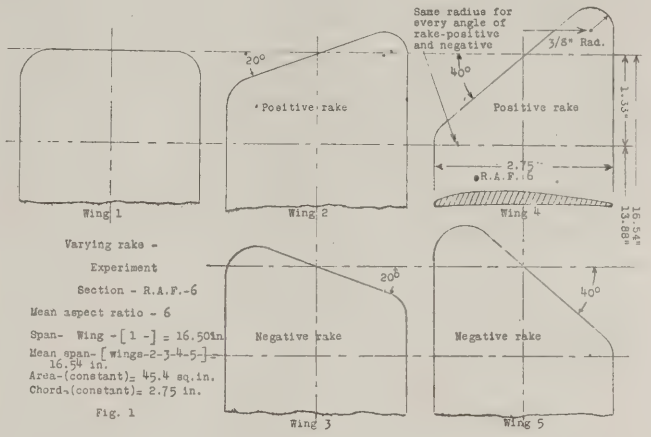


Fig. 1

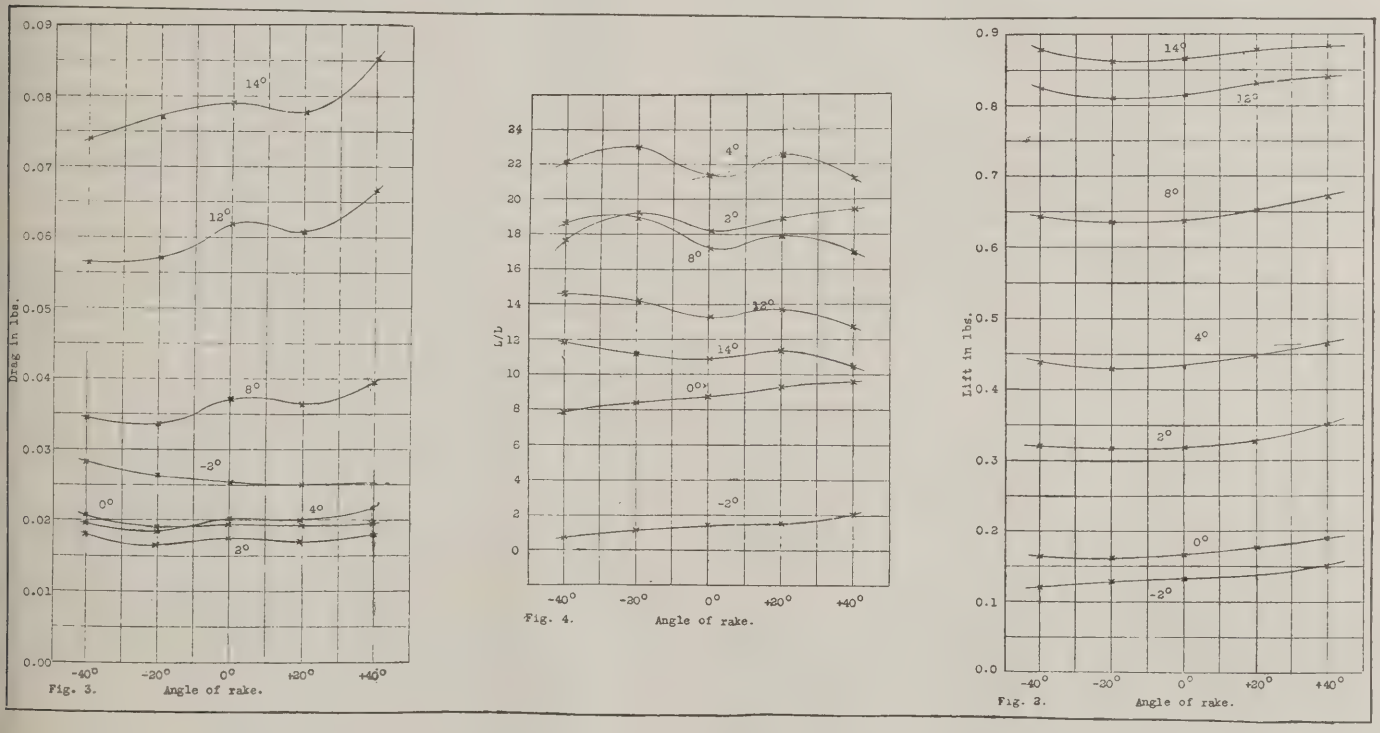


Fig. 3. Fig. 4. Fig. 3.

ESTABLISHMENT OF AVIATION SCHOOLS

By ERICH KEMPE*

IN the establishment of aviation and other technical schools, the greatest difficulty is to obtain suitable teachers. In selecting them, the highest standards must be maintained. It need not be thought that aviation experts will do. Good aviators and mechanics are mostly poor theorists and instructors. Mathematics and theoretical principles can not be taught by an aeroplane pilot who is not an actual professional mathematician. Instruction in assembling and making models may be given by practical mechanics, but this must be under the supervision of a professor, so that theory and practice may be combined.

The object of the instruction in aviation schools should not be to produce aviators, as such, but efficient constructors and thinkers. Flying can be quickly learned at any time, either in connection with the school or related industries.

* Translated from "Flug-Woche," by the National Advisory Committee for Aeronautics.

The whole course of instruction may be conveniently divided into several courses, semesters or years, according to the aims of the institution. If practical aviation is to be taught in the institution, it would be better to leave it till near the end of the entire course.

The subject should be made attractive to the student, however, even during the first year. It is a good plan to take up the historical material, which will furnish entertainment for many a lesson and thus form an agreeable diversion from the dry and difficult material of the elementary subjects.

I have been very succesful on these lines in the Nuremberg aviation school. We have always been limited in the choice of subjects in Nuremberg by the fact that our pupils have been only graduates of the elementary public schools. For more advanced students certain courses (for instance, in mathematics) could be replaced by courses in manual training.

In Nuremberg, the course is divided into four years of eight months, with 12 to 16 work hours per week. By increasing the hours per week, the whole course might be divided into several semesters or quarters with a minimum of not less than three semesters.

First year: descriptive geometry and elementary aeronautic drawing (2 hours per week), history (1), mathematics (4), technics of building materials and fuels (1), elementary aircraft instruction (1). Mathematics and descriptive geometry are absolutely indispensable, if a fitter or technician is to understand his aeroplane or airship thoroughly. Aside from these required subjects, there are the following electives: German and bookkeeping.

Second year: construction (2), mathematics (2), trigonometry (2), physics (1), elementary engine course (1), mechanics and strength of materials (3), elementary aircraft course (1), electricity (1), practice in assembling engine.

Third year: mathematics and statics (2), engines (4), technical aircraft course with construction (3), manufacturing (2), practice in assembling finished engine.

Fourth year: construction and practical exercises on large gasoline engine (4), making giant aeroplanes and balloons (3), aerodynamics, differential calculus, goniometry, meteorology (each 1), making models and gliders with practical instruction in flying, in the first three years compulsory (4).

The courses in descriptive geometry, mathematics, trigonometry, strength of materials, mechanics, electricity, etc., contain what is ordinarily taught in mechanical engineering, but with special application to aviation. On the other hand, the following are purely practical subjects: technical manufacturing, engine courses I and II, aeroplane courses I and II, technology and history. To many people history seems superfluous, but I have not found it so. In the first place, I have learned that the history of the evolution of aviation, with all its interesting stories, like King Bladud, Kaspar Mohr von Schussenried, etc., may be regarded as "sweetening" for the more difficult courses. The eyes of the pupils, older as well as younger, never brighten more than when listening to the recital of these stories. And it is not important to explain with the aid of photographs and sketches the origin of the Montgolfiere and Giffard balloons or the flying machines of Oliver von Malmesbury, G. B. Danti, Leonardo da Vinci, Cayley, Lilienthal, etc., and to show, for example, to what circumstances we are indebted for the modern aeroplane with its rudder and ailerons and other special features? A knowledge of the evolution of the many kinds of balloons and flying machines is essential for the general understanding of flight technics. Anyone taking it seriously has sufficient material for a lesson a week for a year.

The technology of building materials and fuel is divided into chemical and mechanical technology with especial reference to aeroplanes.

The aircraft course is an important one and is divided into elementary and technical courses. The former is subdivided into airship and aeroplane courses. In connection with airships, the course comprises examples of airship calculations, analytical determination of air resistances, expansion, radius of action, insulation, etc. In connection with aeroplanes, individual types, gliding flight, construction, landing gear, fuselage, equipment, etc., are taken up. The technical aircraft course comprises calculation and construction, representation of various forces: thrust, lift, etc., determination of aerofoil shapes, stabilizing, calculation of curves, straight flight, propeller, etc. This course is largely illustrated by original models. The manufacturing course gives an insight into manufacturing, riveting, splicing, autogenous welding, pipe connections, stretching, gluing, sewing, etc. The most important course of all is the one on engines. This is systematically carried out by engine specialists, in calculation, construction and assembling, so far as it concerns practical operations. In all the courses, emphasis is laid on practical exercises, like assembling and dismantling of actual aeroplanes and especially engines, and making drawings.

The equipment is a very important factor. The library should be complete, including all old as well as new works. There should be models of complete aeroplanes and of special parts, engines and instruments for inspection. Review lectures, illustrated by pictures, should be given every month. In the model shops, there should always be kept an abundant supply of materials for making models of all kinds and sizes. Every school year should close with visits to aircraft factories and laboratories, as likewise with competitive flights of models, with distribution of prizes.

ANEROID INVESTIGATIONS IN GERMANY

Abstract of Paper Entitled "Uber Aneroide," by E. Warburg and W. Heuse, Physikalisch-Technischen Reichsanstalt, Zs f. Instrumentenkunde 39:41-45, 1919

Prepared by M. D. HERSEY

Massachusetts Institute of Technology

FOLLOWING an historical review of aneroid development, in which the work of Chree is emphasized, the authors state:

"It would therefore seem well worth while to undertake, through some suitable improvement of the aneroid, to diminish the width of the hysteresis loop sufficiently to make the errors resulting from it practically negligible."

To discover the origin of the loops, experiments were made similar in purpose to the "vivisection experiments," so-called, which were made at the Bureau of Standards and referred to in the Physical Review, 6:75-77, 1915, article entitled, "Aneroid Barometers."

Concluding that the trouble is not in the steel spring, but rather in the diaphragm, a theoretical study is made of the equilibrium of forces acting on the vacuum box. After setting up the fundamental equation of equilibrium

$$T = T_o + f\ z$$

in which T denotes the tension pulling upward on the vacuum box, T_o its initial value when the downward deflection of the box is $z = o$ and when the air pressure p has its standard value p_o; and in which f is a stiffness constant for the spring—the authors proceed to elaborate the terms of this equation by reference to the theory of elasticity.

Two cases are considered—first, that of a thin, flat diaphragm undergoing a deflection which is quite small compared to its thickness; second, the opposite extreme case when the deflection of the diaphragm is quite large compared to its thickness.

The first special case enables us to consider that only shearing stresses normal to the diaphragm exist, radial tensions being neglected. The other extreme case makes just the opposite assumption, namely, that the only stresses which need to be considered are tensions parallel to the surface of the diaphragm. After carrying through the theory of both cases as far as possible, the authors abandon the equations so deduced in favor of empirical observations. Nevertheless, some tentative conclusions are reached which are interesting.

Thus, for the flat diaphragm undergoing only an infinitesimal deflection, the following equations are derived from the theory developed by Goeppl, Vorlesungen uber technische Mechanik, 3:255, 1897; 5:110, 1907:

$$\left.\begin{aligned} s^2 &= s_o^2 - \frac{8\,a\,z}{p\,\rho^2} \\ T &= \pi\,p\,s_o^2 - \frac{p\,\pi\,a\,z}{\rho^2} \\ s_o^2 &= \frac{\lambda^4}{\rho^2} \\ \lambda^4 &= \frac{1}{4}(r_2^4 - r_1^4) - r_1^2 r_2^2 \log\frac{r_2}{r_1} \\ \rho^2 &= r_2^2 - r_1^2 - \frac{4\,r_1^2 r_2^2}{r_2^2 - r_1^2}\left(\log\frac{r^2}{r^1}\right)^2 \\ a &= h^3\,E\,\frac{m^2}{6(m^2-1)} \end{aligned}\right\} \quad \ldots\ldots 2$$

In these equations, to begin with, s denotes the radius of a disk such that the force acting on it due to the pressure p will just equal the actual tension T, and s_o is the value which it has for zero deflection. The symbols α, ρ and λ employed in the first three equations are defined by the last three equations. (In the original text, P is employed for the tension; and the latter a, in German type, appears instead of our α). Further, h = thickness of diaphragm, E = modulus of elasticity and 1/m = cross-section contraction/longitudinal strain. The authors explain why s_o is approximately equal to $(r_1 + r_2)/2$ where r_1 and r_2 are respectively the inner and outer radii of the annular diaphragm.

An original feature of the authors' contribution now appears in their statement that when the deflection is zero, the distribution of load between the rim and the central solid disk is independent of the elastic constants of the diaphragm, and the performance of the instrument momentarily independent, therefore, of elastic after-effect when passing through the position z = o. Conversely, if z is different from o, then, as a result of the term $\frac{8 \pi \alpha z}{\rho^2}$ which now enters, T and with it the distribution of air pressure between the rim and the plate will depend on the elastic reaction of the diaphragm. If, for example, the pressure is changed from p^o to a higher value p, the plate deflects inward, z takes on a positive value, and the elastic reaction of the diaphragm diminishes the proportion of the air pressure which falls on the plate. If any reaction diminishes because of elastic after-effect, then the plate will again be more heavily loaded and will continue its inwardly directed motion.

That part of the elastic reaction of the diaphragm which depends on z is, according to equation (2) independent of the pressure p, remaining, therefore, unaltered in magnitude for zero pressure.

If one substitutes into equation (1) the value of T obtained from equation (2) and takes account of the fact that, according to the equations (2)

$$T_o = \pi\ p_o\ s_o^2 \qquad (2a)$$

one finds for the sensitivity of aneroids with very small pressure changes

$$\frac{z}{p - p_o} = \frac{\pi\ s_o^2}{f + \frac{8\ \pi \alpha}{\rho^2}} \qquad (3)$$

The aneroid diaphragms used were made of .02 cm. thick German silver for which, with $1/m = E = 11\ 10^5$ kg/cm, $\alpha = 1{,}7$.

From equation (3) it is evident that the influence of elastic after-effect on the indication of an aneroid in the contemplated case diminishes with diminishing thickness of the diaphragm, and with increasing spring constant f, this last in so far as the after-effect of the diaphragm is greater than that of the spring.

In the second extreme case, the authors neglect the bending stresses and stresses normal to the diaphragm, and confine their analysis to the tensile stresses in the neutral surface. Consider the radial distance r_o at which a tangent plane touches the surface of a diaphragm which is simultaneously deflected down by pressure p and up by tension T. At the point of tangency the tensile stresses have no vertical component, therefore

$$T = \pi\ p\ r_o^2 \qquad (4)$$

Thus the distribution of load between the outer ring and the central solid disk depends only on the value of this radius r_o.

For the case of zero deflection, supposing the diaphragm initially flat and free from tensile stresses, when p = o and T = o, a solution is quoted from Foeppl, (op. cit. 5:144, 1907), according to which the deflection ζ as a function of the variable radius r is given by the equation

$$\zeta = \sqrt[3]{\frac{p}{h\ E}}\ \Phi\ (r_1, r_2, r) \qquad (5)$$

and therefore the distribution of load is here also independent of the nature of the diaphragm and consequently the after-effect has no influence on the displacement whenever the latter happens to be zero. But the cases when the displacement is not zero it has not been possible to treat theoretically.

The difficulties of treating corrugated diaphragms are then alluded to, and experiments described in which the diaphragms were loaded with weights T which were varied over a cycle for different constant values of the air pressure p.

The results could be represented by the formula

$$T = ap - Qz + Rz^2$$

where

$$Q = b + cp + dp^2$$
$$R = \beta + \gamma p + \delta p^2 . \qquad (6)$$

In most cases R = O so that

$$T = ap - (b + cp + dp^2)\ z \qquad (6a)$$

As a first approximation it is shown that s_o is again approximately equal to the average of the two radii if one replaces the empirical constant a by the term $\pi\ s_o^2$. Hence, approximately the coefficient a is independent of the nature of the diaphragm so that here again the distribution of the load between the central disk and the rim can not be influenced by after-effect whenever the displacement is zero.

The coefficient b is found to be about forty times as large in the experiment as it would be from the first of the theoretical deductions; moreover, it is found experimentally that b is approximately proportional to the thickness of the diaphragm, whereas, according to the theory given, it should vary with the cube of the thickness. This seeming discrepancy is sufficiently explained by the fact that the observations dealt with large deflections, such as were not contemplated at all in the theory quoted; moreover, the observations were made on corrugated diaphragms.

It is concluded that the coefficients b, c and d, particularly the first, depend on the properties of the diaphragm metal and serve to explain the hysteresis loops.

Upon substituting the value of T from equation (6) into equation (1), and taking the approximate condition R = O, there results the following approximate expression for the sensitivity of an aneroid in terms of the coefficients a, b, c, d and f. The authors consider that this expression warrants special attention because of its simplicity, and because it is reliable to 5% in the cases which they have investigated:

$$\frac{z}{p - p^o} = \frac{a}{f + Q} = \frac{a}{b^t f + cp + dp^2} \qquad (7b)$$

Dropping the theoretical discussion, the authors announce the conclusion that the means available to diminish the effect of imperfect elasticity in aneroid barometers appear to be three in number, viz.:

I. Select a specially good quality material for the diaphragm. The authors state that they have been able to find nothing superior to hard German silver. But it is important to reduce the thickness of the diaphragm, which they have carried with advantage from the usual .2 mm. down to .05 mm. The diaphragms should be pressed into shape by hand and thereby hardened, for softening was found to make the after-effect excessive.

II. Use a stiff spring so as to have large values of f. If this diminishes the sensitivity of the aneroid too much, one can restore this sensitivity somewhat by increasnig the multiplying power. If this in turn entails too much friction in the mechanism, resort can be made to the vibration device of Mr. Goeppel. This consists of a steel plate attached to the aneroid and caused to vibrate by means of a toothed wheel operated by hand.

III. The foregoing theoretical equations assume vacuum boxes with only a single diaphragm. If both the top and bottom are made flexible, the equations can readily be modified; for example, 7b becomes

$$\frac{z}{p - p_o} = \frac{a}{f + \tfrac{1}{2} Q} \qquad (8)$$

The double surface box reduces the influence of after-effect, therefore, to about one-half what it would be otherwise.

These three principles have been applied to a number of aneroids constructed in the Reichsanstalt shops, the constants of which the authors proceed to give, and the effect of substituting various stiffnesses for the spring and making certain changes of multiplying power are reported numerically. The numerical effect of these substitutions on the observed hysteresis loops is finally given and shown to be quite marked.

In their concluding summary, the authors state that by means of the three methods given, they have succeeded in producing aneroids for which the greatest width of the hysteresis loop between 760 and 410 mm. is not over 2 mm. (It is not very clear how much time the authors allowed for "drift" to take place at the minimum pressure during the tests which established these hysteresis figures; it is merely stated that the rate of change of pressure was about 5 mm. per minute. Their result of slightly over one-half of one per cent is exceptionally good, although by no means surprising if there were direct-return pressure cycles, that is, without prolonged delay at the lowest pressure.)

GÖTTINGEN WIND TUNNEL FOR TESTING AIRCRAFT MODELS*

GENTLEMEN, my intention is simply to give you a brief description of the Göttingen wind tunnel. I shall first say a few words as to how such a plant came to be installed in Göttingen.

The beginning dates back to the "Motorluftschiff Studiengesellschaft" (Society for Airship Study), which was founded in 1906. On the recommendation of the Göttingen Professor of Mathematics and Physics, Felix Klein, and E. Althoff, who was the real founder of the "Motorluftschiff Studiengesellschaft," I was made a member of the Technical Committee, whereupon I called attention to the need of experimenting on models, as had long been done in connection with ship building. The idea found favor and the Motorluftschiff Studiengesellschaft appropriated, at my suggestion, the sum of 20,000 marks, with which the first small plant was begun in Göttingen in the late autumn of 1907. In 1908 it was completed and equipped. The equipment was then gradually tried out and in 1909 we were engaged in practical work. During the war we performed a large share of the experiments reported in the "Technische Berichte der Flugzeugmeisterei" (Technical Bulletin of the Air Service Administration). From the beginning it was of a temporary nature and could not be expected to be permanently satisfactory. It was doubtless better not to build immediately on a large scale, but to wait till the requirements had been carefully worked out. The small plant, however, considering that it was the experimental basis for an ultimate larger and more complete plant, did very satisfactory practical work.

The endeavors to obtain a second building go quite far back. I wrote the first presentation of facts in February, 1911. In 1912 we won the interest of the Emperor William Society for the Promotion of the Sciences. It was again Felix Klein who encouraged me, and it was our former chairman and present honorary member, Mr. Böttinger, who followed up the difficult negotiations with the Emperor William Society so energetically that in 1914 the project was on the point of realization.

Then came the war and our plans were brought to a standstill. We figured indeed on a short war, and no one thought at first of undertaking scientific work with increased energy. But at the beginning of 1915, when we saw that the war was going to last longer, we undertook to attain our goal by a different road, and this time with the support of the military authorities. The Emperor William Society, on the basis of a petition from me, backed by our honorary president, Prince Henry, secured from the war administration an appropriation of 200,000 marks which was afterwards increased to 300,000. Thus the way was opened for us to carry out our plans, and indeed, on a considerably larger scale than the project of 1912.

Naturally there were many obstacles to be overcome even in 1915, and still more during the actual building period. These delayed its completion, after the foundation was begun in the autumn of 1915, till the spring of 1917. Since then the plant has been in constant operation, with a permanent increase in personnel, to meet the needs of the war administration and the aeroplane factories. The scientific work was not neglected, however. Concerning that I had the privilege of addressing you in a theoretical lecture last year in Hamburg.

The plant finally reached a personnel of 50, including engineers, officials and workmen, though it has now been reduced to a third of that number. It is evident that such high pressure (we were then working in two daily shifts) could no longer be justified after the war, as there was no longer any necessity for it. For a long time we were anxious lest the plant would have to be closed altogether for lack of means, since it had not been running long enough during the war to earn any considerable amount of money. It received frequent generous contributions from the war administration for all uncovered expenses. We are hoping that the plant, which has thus been compelled to live from hand to mouth during the last few years, will now be set firmly on its feet. On December 3, 1919, a society was founded, with a membership fee of 1,000 or more marks, which is expected to support the plant for five years. I exhort those in this assembly, who are in a position to do so, to support the plant by joining this society. The expectation is that about half of the running expenses will be paid by the government, while the remaining half will be furnished by the Emperor William Society, by the Göttingen Society for the Promotion of Applied Mathematics and Physics, and by this new supporting society. On this basis, we hope to continue the work during the next few years at least as efficiently as during the past year.

Fig. 1 shows the old 9 x 11 m. plant. In the sectional plan is shown the cylindrical tunnel in which a rotary fan V generates an air current as indicated by the arrows. Various devices serve to keep the air current as free from disturbances as possible. An airship model is shown in the experiment room (M).

In the sectional elevation of the building there is again shown the experiment room with the model, while half of the left side shows the fan and the other half the so-called honeycomb (G_1), a system of parallel cells designed to eliminate diagonal currents.

The old plant was taken down in 1918. The new plant is a substantial building with a hall of reinforced concrete, containing the apparatus, while the front part of the building contains the office, work-room and watchman's room. The restored and improved old building is added to the rear end.

In Fig 2 are shown a plan and a sectional elevation through the laboratory and tunnel. The laboratory is traversed by a 4-ton hand travelling crane. The wind tunnel makes a complete circuit. Its cross-section varies, however, and it is interrupted in the testing room. The open testing room was copied from the Eiffel laboratory. We recognize the Eiffel entrance cone and collector, but in contrast with the Eiffel tunnel (which

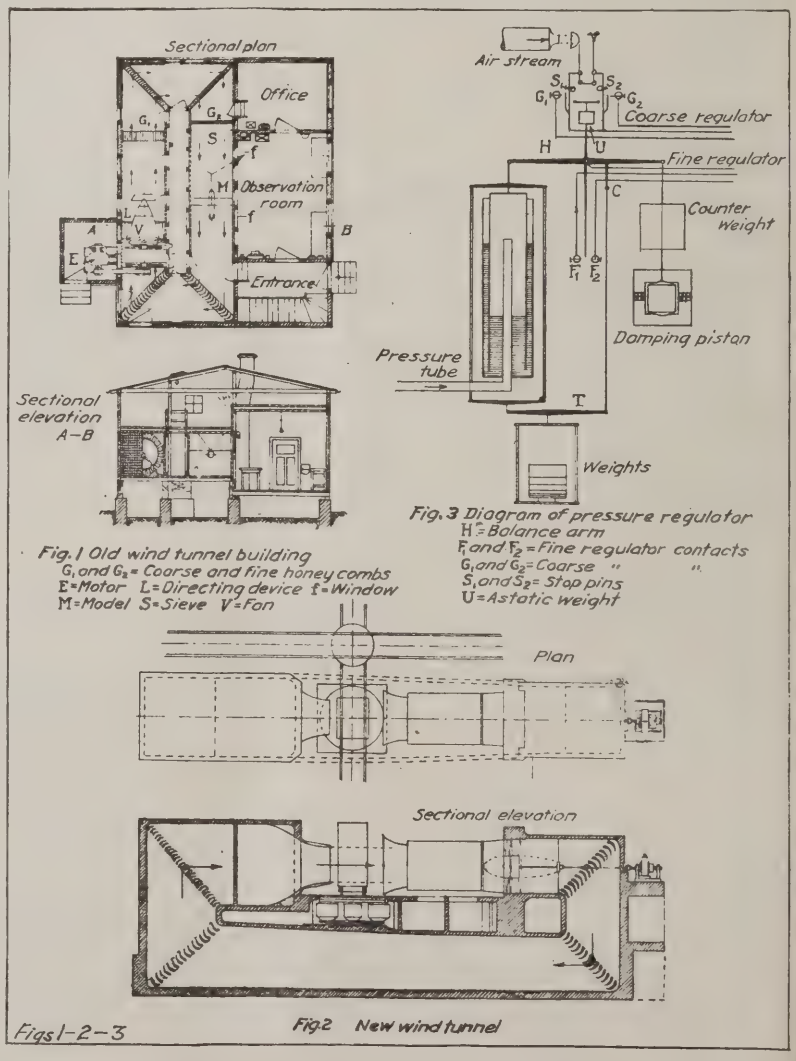


Fig. 1 Old wind tunnel building
G_1 and G_2 = Coarse and fine honey combs
E = Motor L = Directing device f = Window
M = Model S = Sieve V = Fan

Fig. 3 Diagram of pressure regulator
H = Balance arm
F_1 and F_2 = Fine regulator contacts
G_1 and G_2 = Coarse " "
S_1 and S_2 = Stop pins
U = Astatic weight

Figs 1-2-3 Fig. 2 New wind tunnel

* From "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt," a supplement to "Zeitschrift für Flugtechnik und Motorluftschiffahrt," September, 1920.

A more detailed description will appear later in the form of a book containing the results of the experimental work of the plant.

begins at the entrance cone and terminates behind the blower, because there must be an airtight room for the experimenter on account of the partial vacuum at the testing point), we have enclosed the return current and are therefore able to make the testing room perfectly accessible. We can enter the testing room with the crane and we can run the testing apparatus (which is provided with wheels) in on tracks. The location of the tracks is shown in the plan. In order to obtain more room for the apparatus, two bays were built, one on either side of the main hall. If, after an aerofoil experiment, a propeller test is to be made, the latter can be prepared in one of the bays and then run in when everything is ready. This is one great advantage of this plant. Another advantage consists in the smoothness anr uniformity of the air current resulting from the series of curved streamlined deflectors in each corner.

Still another advantage lies in the fact that the width of the cross-section behind the blast gradually increases and is then greatly reduced shortly before the measuring place. Thus we have a cross-section of 20 sq. m. back of the entrance cone and of only 4 sq. m. at the testing point. This increases the speed fivefold and the momentum twenty-fivefold, from which it follows that the irregularities ensuing from the inflow only relate to values of 1/25 of the momentum previously obtaining. Thus, without special adjustment, uniformity is assured in the experimental cross-section to within 4% of the momentum, and 2% of the speed. Since the uniformity in the inflowing current is fairly good to start with, it is very satisfactory in the experimental section. In contrast with the former plant, where we could obtain uniformity only through tedious adjustments which, in the course of time often had to be repeated, we here obtained a satisfactorily uniform current at the very outset.

A great saving of power is effected by the arrangement in the new plant. In the old tunnel, with its uniform cross-section, there was a great loss of energy in eliminating the eddies. We have therefore put the straightening device, a honeycomb with cells of only about an inch diameter, in the position of least velocity, thereby causing only a small loss of energy. The energy emerging from the entrance cone, aside from the losses in the open stretch, is utilized in the further circulation, since the whole stream is again collected. In this way the kinetic energy of the air stream in the experimental section is nearly 1½ times the energy of the blast at the driving shaft of the blower. This is made possible by the fact that the kinetic energy is partially recovered in the collector. Hence only about ⅔ of the air energy needs to be furnished at the blower shaft.

In Göttingen we have an alternating current which renders the regulation of the r.p.m. difficult. Consequently, we have installed a motor-generator set (consisting of an induction motor which drives a dynamo) by which the blower motor is driven. The power plant also includes a smaller dynamo for driving the propeller-testing device and an exciting dynamo.

Both dynamos are so-called Ward-Leonard dynamos which can be run at different voltages, so that the blower may be driven at any desired speed from 50 to 1100 r.p.m. In this connection, there is a regulation system, consisting of a coarse and a fine regulator, which influences the field excitation of the dynamos. The fine regulator is operated automatically by a pressure balance or regulator.

Fig. 3 is a diagram of the pressure regulator. It is quite complicated, and I will not try to explain all its details here. The essential points are as follows: The excess pressure in the entrance cone, where the contraction from 20 sq. m. to 4 sq. m. takes place, is communicated by a pipe to the inside of a movable cylinder inverted in a stationary cylinder containing some sealing liquid. The diagram shows how the pressure makes the level of the liquid lower inside than outside the movable cylinder, thereby exerting an upward force corresponding to this difference in level, against the horizontal balance arm H. The equilibrium of the balance is restored by placing weights on the pan at the bottom, these weights being of such values as to give air speeds of 10, 15, etc., up to 50 m. per sec. In the new plant this device is perfectly automatic, while in the old plant a coarse hand adjustment was necessary. In fact, it is only necessary to press a button to set the whole machinery in motion, which automatically adjusts itself to the speed at which the balance arm is horizontal. The whole machinery is stopped by pressing another button.

The maximum power at the blower shaft is about 300 h.p. With such a small electric power plant as that of Göttingen, care must be exercised not to make great load increases too suddenly. The automatic regulator takes care of this.

In Fig. 3 the coarse regulator is shown above the balance arm. It is provided with a special system of springs under compression, so that contacts can only be made when the balance is very unevenly loaded. As soon as an approximate adjustment is made, the coarse regulator is switched off and the work is taken up by the fine regulator, which is shown below the balance arm. It is so arranged that the fine regulator, after reaching its limit, switches the coarse regulator a step further and then another step and does this gradually, so that as soon as the coarse adjustment is made, the fine regulator resumes its work.

In this regulation there was the difficulty that it could not be made, as in the case of a steam engine, for a fixed r.p.m., but must proceed by air speeds from 5 to 50 m. per sec., thus covering a range of 1:10. Such a requirement is made of no engine regulator. Consequently, we were obliged to invent devices (as, for example, the stabilizing of the balance arm by means of the rods C and T) which, I am free to confess, consumed considerable time. This makes the balance arm slower in its movements as more weights are added. When there are no weights on the pan, it is so balanced by the weight U over the pivot, that the balance arm swings almost astatically.

There are many other details not shown on the diagram and which I have not the time to describe, as, for example, a device for preventing over-regulation and an adjustable device for damping the oscillations, etc.

Fig. 4 is an accurate representation of the entrance cone, which can be turned slightly up or down and to the right or left. This is necessary for accurately adjusting the direction of the air current. The forces acting on the balance are resolved into vertical and horizontal. In adjusting this balance, its weight has an influence, for one hangs weights on

(*Continued on page 302*)

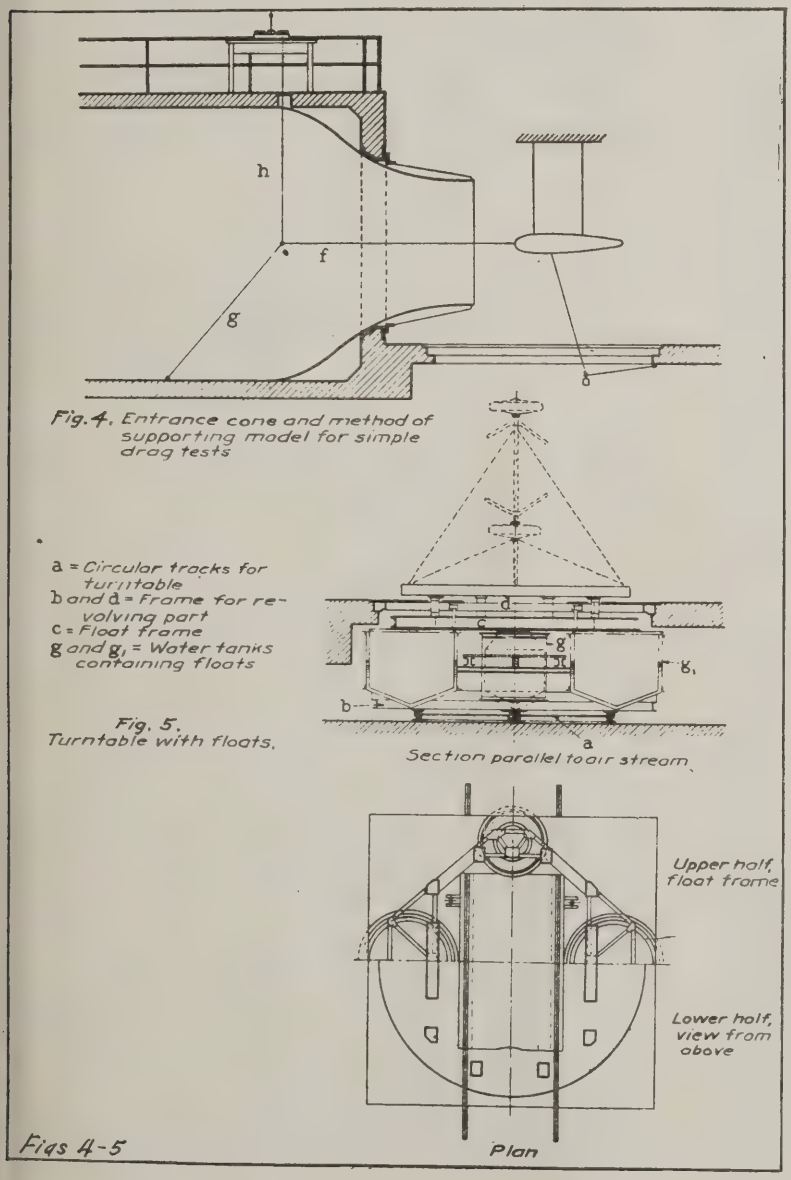


Fig. 4. Entrance cone and method of supporting model for simple drag tests

Fig. 5. Turntable with floats.

Figs 4-5

THE MANEUVERS OF GETTING OFF AND LANDING *

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART II.—"GETTING OFF"

3. "Getting Off" as a Forced Maneuver

(*Continued from page 278*)

This paragraph will deal with getting off under unnatural conditions. Suppose the pilot has to fly an aeroplane out of a small field surrounded equally by obstacles, he would naturally wish for a strong wind against which to get off; suppose again that the field is restricted on three sides and the wind is blowing from one of the sides adjacent to the open side, the obstacles on this side being too high for him to surmount, he has the choice of getting off either with a climbing turn, or if there is not enough room for this, towards the open side across wind. It should be noted that more frequently than the actual space of ground available before the wheels lift, it is the obstacles which surround it that worry the pilot, at least in English country.

Take the first case, where the pilot is compelled to surmount the obstacle. Unless it takes the form of steadily rising ground, the pilot would, during the third phase, hold the aeroplane down near the ground gathering as much speed as possible, and then, using up all the energy available to lift him clear, "zoom" as he approached the obstacle and allow himself to sink on the farther side. He could thus surmount a higher obstacle than if the third phase took the form of a steady climb. If, however, the condition at the farther side of the obstacle is to be that of steady climb, R. McKinnon Woods shows, in a theoretical analysis, that nothing is gained by the "zoom." Nevertheless, not only does a "zoom" enable the pilot to surmount a higher obstacle if he allows himself to sink on the farther side, but it means that during the period of the third phase, in which he is holding the aeroplane near to the ground, he will due to his speed have a greater margin of control in preparation for the final effort. If the pilot tries to surmount the obstacle by a steady climb, he is liable to attempt the climb at a very low air-speed, probably lower than his best climbing speed, under the impression that he is climbing faster due to the steep attitude of his aeroplane. In a steady climb at a low air-speed his control will be difficult throughout a sustained period, while in the "zoom" the period during which his control is reduced to a minimum is very short. In the kind of get-off just considered, the pilot naturally makes full use of any head wind there may be.

The second case, where in order to avoid the obstacle the pilot has either to get off with a climbing turn up wind or else straight and across wind, is a different one. The pilot's handling during the climbing turn and when getting off across wind have already been dealt with. If the wind is strong, the climbing turn would probably be preferred; if gentle, the get-off across it. A certain amount can be done to assist the get-off by holding back the aeroplane on the ground by artificial means while the pilot opens the engine full out, and then letting it go; but the pilot must be very sure of his powers of holding down the tail in the slipstream before he can practice this with safety (ref. Part II., para. (1) (*d*)).

If the surface on which the pilot has to get off is wet and sticky, he has to allow very much more time to get clear. As was stated before, he can only try to keep his tail down as much as possible, and never to get off on sticky ground down wind.

The last thing to be considered under getting off is engine failure. This must occur when the pilot is still under the influence of the ground, and from such engine failure more crashes result than from any other one cause. If the engine fails during the first or second phases, the aeroplane can nearly always be brought to rest by the pilot without damage of any consequence. In the third phase his situation is one of peculiar difficulty. When getting off, the pilot should always attempt so to maneuver his aeroplane that should engine failure occur at any moment during the third phase, he will be able to effect a landing on reasonably good ground. With some aerodromes this is difficult; with many fields it is impossible. Nevertheless, it is an aim which should never be lost sight of, and in pursuance of which the climbing turn is particularly helpful. If there is a good piece of ground outside the aerodrome in the upward direction, the pilot should not fly directly towards and over it, for if his engine fails it may be hidden from view beneath his wings; he should maneuver so as to be just on one side of it, so that he always keeps it in view until the completion of the third phase.

If the engine fails near the ground, the trim of the aeroplane may be violently upset, both longitudinally and laterally, and the pilot is bound to lose some height before he regains mental equilibrium and brings the aeroplane to a safe gliding attitude. The chief cause of crashes seems to be the desire of the pilot to turn back down wind in an attempt to land in the aerodrome which he has just left. It is surprising how long it appears to take after climbing steeply with full engine to gain a margin of speed gliding, and how much it appears necessary to depress the nose of the aeroplane. And this must be attributed to the proximity of the ground. The pilot is tempted to commence his turn back before he has gained sufficient gliding speed, and so commences a spin at a low altitude from which there is no recovery. If he has not enough height—300 feet is about a minimum—it is imperative that he should glide on and make some sort of a landing even in very bad ground. It is better to approach bad ground with the power to flatten out than good ground without it. Another feature of the turn down wind is the way in which the apparent rate of travel of the ground up and down wind deceives the pilot. As he turns down wind he thinks he is going faster than he really is, which as it occurs on a turn, puts him, unless he takes the greatest care, in danger of stalling. It is far better to trust to the air-speed indicator reading than to watch the ground under these conditions, and make sure that the margin of speed really exists; for in gliding the stall develops so quickly after the controls first begin to feel sloppy, and the imminent approach of the ground appears so rapid, that the pilot has little chance to correct his error. His best plan, just as in the case of the "zoom," is to dive and gain as much speed as he can before approaching the ground; and rather than commence the turn at a dangerously low speed, carry it out with what speed he can gain during the dive.

The question of engine failure in getting off naturally leads up to a consideration of landing, and engine failure at the beginning of the third phase, when the wheels have just left the ground, will be discussed under that head.

PART III.—LANDING

1. Factors Which Particularly Influence "Landing"

As the factors to be discussed are mainly those which influence the flying qualities near stalling speed, most of them are common to the maneuvers of "Landing" and "Getting Off." As we stated in Part I., para. 2, the period of landing will be divided into two phases; the moment of contact with the ground terminates the first and introduces the second.

The factors which particularly influence landing may be enumerated as follows:

(*a*) The absolute dimensions of the aeroplane.
(*b*) The loading.
(*c*) The stability characteristics and the balance of the aeroplane.
(*d*) The control surfaces and their effectiveness, especially at low speeds.
(*e*) The effect of the slipstream.
(*f*) The height, relative position and character of the undercarriage.
(*g*) The angle of the aeroplane to the ground with the tail down, and the height of the wings above the ground.
(*h*) The pilot's view of and his height from the ground, and his position relative to the C.G. and to the wings.

(*a*) Taking the four sizes of aeroplane considered in Part II., para. 1 (*a*), it may generally be stated that the twin-engined type is more difficult to marshal to the landing position, though simpler to land when correctly in position; that the scout and smaller single-engined two-seaters are easier to maneuver for position, but actually more difficult to land. The very large aeroplane is seldom maneuvered at all, just simply flown in, using one group of engines to prolong the glide. The three phases of getting off require a steady effort of judgment the whole time, while although the approach to land does require nice judgment, the chief effort during landing is more especially concentrated round the few critical moments when the aeroplane is just about to touch the ground. During these moments the timing of the stalled condition must be in complete harmony with the aeroplane's height above the ground, for the slightest error spoils a good landing and involves a disproportionately bad one. Though a bad landing may be saved by the use of engine, it is nevertheless a potential crash.

* Lecture delivered before the British Aeronautical Society.

The larger types of aeroplane are as a whole easier to land because they are more sluggish and extend the critical period just before contact, so that the pilot has at least the chance of correcting small errors. On the other hand, the smaller aeroplane is more handy during the approach; natural drift can be quickly eliminated, or artificial drift introduced to meet abnormal conditions. If a large aeroplane is drifting near the ground, its sluggishness inhibits the quick removal of the drift. If the smaller aeroplane becomes partially stalled, speed may be regained in time to flatten out. The response of the larger aeroplane under these conditions is so slow that it is actually necessary in order to flatten out to get up a considerably higher speed than would normally be required.

(*b*) Most pilots have noticed the difference in the stall of an aeroplane when it is flown light, and then loaded up heavily. When light, the engine may be switched off and the nose gradually pulled up until the aeroplane sinks gently and puts its nose down again. Load the aeroplane up, however, carry out the same stalling operations, and the aeroplane will answer the elevators until suddenly it drops the nose, usually in conjunction with one wing, and feels as if it wants to spin. Furthermore, the stall occurs at a higher speed. There is a double reason for precluding such slow safe flight; the stall occurs sooner, and the flying qualities associated with it are worse.

As in getting off, the large heavily-loaded aeroplane is worse to handle than the small one. With the small racing scout loaded to an abnormally high figure, the pilot takes his own risk about landing; but as long as landing is purely an effort of judgment, safety on the larger commercial aeroplanes must demand a low landing speed. The tendency is therefore to search for wings whose form may be varied in flight in order to increase the speed range of the heavily-loaded commercial aeroplane by giving an absolutely safe landing speed while retaining a reasonable top speed. Whether the speed range be increased by relatively high power with a fixed wing section and a high landing speed or by variable camber wings and a reduction of the landing speed, there is a definite effect produced on the pilot. If he flies an aeroplane with a big speed range and attempts to land at, say, a third of the speed at which he has been flying, he has, due to the lag of his senses in accommodating themselves to the new conditions, the feeling that he cannot reduce his speed to what appears to him a ridiculously low figure; he feels that he must be stalling, and consequently tends to come in to the aerodrome too fast. With a big speed range it is really difficult to make use of the very lowest speeds that may be safely possible. The pilot is always going faster than he thinks. This effect is particularly noticeable if high speed aeroplanes are watched coming in after a race. They nearly always, allowing for the high loading, tend to come in unreasonably fast because of the pilot's difficulty in adjusting himself. Motorists experience this when a ten-mile limit is approached after motoring fast on the open road.

(*c*) The longitudinally unstable aeroplane is more difficult during the earlier part of the first phase of landing, the stable aeroplane more difficult actually to land. Taking into account what was said about relative size, the large unstable aeroplane is to be avoided at all costs. When in the first phase the pilot is approaching to land the unstable aeroplane, he has to maintain it at the correct speed, and is more likely to be deceived into stalling, especially on a turn; the stable aeroplane, if the tail adjustment admits, and it should admit, can be made to assume a natural gliding speed without trouble, to which it always tends to return.

It will be seen that an unstable aeroplane, although near stalling its instability tends to be reduced, really tends to land itself. The wheels and tail-skid will have probably made contact with the ground before the nose-diving couple is felt. If the unstable trimming speed is arranged to coincide with or slightly exceed the desired speed of glide, the pilot has only to release the control stick at the right moment and the aeroplane will naturally stall itself gently on to the ground; in any case, with very little effort the pilot can gently check or assist the motion to bring about a favorable conclusion.

If the aeroplane is stable and is set to trim at the desired speed of glide, the stalling moment of the elevators will be progressively opposed by the effect of longitudinal stability, until just before contact with the ground the nose-diving couple requires the full upward movement of the elevator to counteract it. The movement of the control stick to flatten out begins gently and ends in a comparatively violent pull right back that must be perfectly timed; if it is made a moment too soon, the control is all used up and the nose-diving couple bangs the wheels on the ground. The onset of the nose-diving couple may be in some measure postponed by arranging the trimming speed to be slower than the desired speed of glide, that is, making the aeroplane feel slightly tail-heavy gliding; but this always introduces the tendency to stall during the earlier part of the first phase.

Unlike longitudinal instability, lateral instability does nothing but increase the pilot's difficulties. Dihedral certainly postpones the dropping of one wing, and aeroplanes with no dihedral drop one wing very quickly and land hard on one wheel if not stalled directly on to the ground. But practically all aeroplanes show this tendency to some degree, which is just what the aeroplane, as a structure, will not stand. The drop that an aeroplane will stand up to on one wheel is insignificant compared to the drop on both wheels equally; and it is nearly always heavily-loaded aeroplanes that upset the pilot by suddenly dropping a wing.

(*d*) Professor B. M. Jones has said that a truer criterion of the landing difficulty than the stalling speed is the slowest safe speed of maneuver near the ground, and sugegsts that although in general the margin of speed necessary with different types is at present of the same order, this margin could be materially reduced if the control near stalling could be improved. I think that it is on the confidence that the flying qualities near stalling give to the pilot that he bases his judgment of the lowest safe speed. In most aeroplanes the lateral trouble develops first; and if the aeroplane, though highly controllable longitudinally at low speeds, is vicious laterally, the extra longitudinal control will avail the pilot practically nothing. It is essential that if the flying qualities near stalling are to be improved the lateral and longitudinal be kept on a par; and in present-day aeroplanes the lateral element needs improving to bring it up to the longitudinal.

A feature that tends to mar the longitudinal control is a large difference of trim with engine on and off. Not only should the range of the adjustable tail be amply sufficient to cope with this, but the difference should be reduced as much as possible to make the necessity of a large tail range remote. The pilot does not want to be hampered in making full use of his primary organ of longitudinal control, the elevator, by compulsory attention to his secondary organ, the adjustable tail plane. Especially does this hold should he be compelled to make use of his engine suddenly to save a bad landing. He has no time or energy to concentrate on anything but the simplest control mechanism when he is in close approach to the ground.

During the war a form of air brake was fitted to a service aeroplane with the idea of increasing the gliding angle and pulling the aeroplane up on the ground. H. Glauert has pointed out in R. & M. 667 that the speed drops so rapidly in the run along the ground as to render such brakes of little use. The increase of gliding angle certainly does assist the pilot to get into a confined space over obstacles, but a distinct danger arises from the fact that the pilot is likely to bring his air brakes into action while coming in without realizing what his change of gliding angle means. To glide in at the same speed he must keep his angle of incidence the same, and so must rotate the body of the aeroplane through the change in gliding angle. Because he suddenly glides steeper the idea is presented that he is going correspondingly faster, and on this assumption he may commence maneuvers which he would not otherwise attempt. It is always a question whether it is wise for the pilot to change the characteristics of his aeroplane when under the influence of the ground.

In getting off, with the point at which he leaves the ground as his starting point, the pilot has, within fairly wide limits, freedom as to his subsequent direction; his lateral control is mainly necessary for counteracting casual disturbances and only in a wide sense for voluntary maneuver. In landing, on the other hand, his maneuvers are executed with the express purpose of arriving at a definite point; and, if he is unwilling to face judging a long straight glide or relying on his engine, they may be termed compulsory, almost involuntary, maneuvers. His lateral control is then more important still, for it has to be utilized to counteract disturbances simultaneously with the execution of low-speed maneuvers. Although the aileron control has not been found in practice to reverse, the yawing moment due to the ailerons is more noticeable even than in getting off, probably owing to the small slipstream effect on the rudder. Some pilots actually appear to utilize the yawing moment to assist maneuvers for losing height at the edge of the aerodrome, but unless the pilot is experienced, considerable risk is involved.

The rudder control suffers badly at low speeds, for if the rudder is made small enough to be reasonably light at high speeds, it is usually overpowered by the ailerons near stalling. This may be, and is, partly overcome by the use of balanced rudders, but the balancing itself, if carried out to any extent introduces other difficulties.

Some aeroplanes, especially those without steerable tail-skids, show a tendency to spin round on the ground during the second phase, and the rudder is not sufficiently effective to prevent this spin. The pilot might give the rudder more power by a burst of engine and the subsequent slipstream effect; but he is often unwilling to increase the speed at which he is running along when on a turn. In any case it is unwise to check

the turn too violently; the aeroplane should be allowed to go on turning until nearly all speed is lost before risking a burst of engine.

(*e*) It is not always sufficiently realized how different an aeroplane feels when the engine is throttled down for gliding and when it is completely switched off. The pilot relies more than he knows on this slipstream effect, small as it is, to assist his rudder. If his engine fails completely, and he has not tried flying the particular type of aeroplane with no engine at all, he frequently experiences a feeling of helpfulness for a few moments until he has accommodated himself to the new conditions. The rudder control of many aeroplanes at low speeds without any slipstream is by no means satisfactory, neither are these difficulties imaginary.

When carrying out maneuvers for losing height at the edge of the aerodrome the pilot finds an occasional burst of engine of the greatest use to assist his control. These bursts of engine are not always given, as is often supposed, to prolong the glide. As has been stated before, the secret of maneuvering at low speeds is the co-ordination of the rudder and ailerons; lack of co-ordination means a loss of height, and more important, of direction, before the error can be corrected. The pilot is thus hindered in his attempt to arrive at the desired landing point. When the rudder and ailerons are not co-ordinated properly, the aeroplane, if on a turn, seems to stick, or its motion becomes jerky. A burst of engine, espesially in a large aeroplane, will often relieve this condition at once by assisting the rudder.

(*f*) If the undercarriage is high, the pilot feels that his aeroplane as a structure is top heavy during the second phase of landing. If for a moment the value of a large angle of the wings to the ground is set aside, the pilot always feels safer if the vertical distance from the wheel axis to the C.G. and to the line of thrust is kept to a minimum, because the overturning tendency is thereby reduced. He further realizes that if he does go over, the impact will be much less severe.

The necessity of ground feel, advocated for getting off, is of no importance in landing, probably because the conditions of the second phase of getting off are generally avoided. In landing, the aeroplane is either definitely air borne or running along with its tail-skid on the ground. In getting off it was noticed that an Oleo type of undercarriage tended to eliminate the ground feel which was of value to the pilot, whereas in landing this is of no moment, and excellent shock-absorbing properties are essential to preserve the structure from damage.

One of the worst features of the present-day undercarriage is its incapacity to stand up to lateral loads. The pilot has always to concentrate on eliminating drift prior to contact with the ground. This, due to the bad rudder control at low speeds, is often difficult to achieve. Consequently a large proportion of minor crashes are due to landing with drift and the subsequent collapse of the undercarriage.

In the simple "V" type of undercarriage, the wheel position, which even now is quite a delicate matter to determine, is of the greatest importance. It usually has to be settled by practical trial. If the wheels are too far back, the overturning moment may be more than the controlling moment of the elevators with the reduced slipstream, especially if the aeroplane bounces in landing. If the wheels are too far forward, the aeroplane is inclined to "bucket" and an oscillation is set up, which if not taken in hand by the pilot and damped at an early stage, may also result in the aeroplane turning over. If the aeroplane starts to "bucket" the tail-skid receives severe shocks. The only advantage of wheels placed far forward is that landing on soft ground is made easier. The advantage to the pilot of such a wheel position can be reproduced on commercial aeroplanes where the maximum reduction of weight and resistance is not so essential as in war aeroplanes, by wheels placed in tandem. If ground brakes are employed, and it seems likely they will be necessary in future, tandem wheels are essential. H. Glauert points out in R. & M. 667 that if ground brakes are employed a reduction of the run is only effected by increasing the angle of the wings to the ground above the critical angle. If the increase of angle is within limits below the critical angle, the run is not sensibly shortened.

Especially on large aeroplanes a wide wheel track is of great advantage in steadying them if they are not landed with the wings level. One small scout at least has been successfully fitted with a wide track undercarriage. Although this aeroplane is inclined to oscillate sideways due to uneven ground, it lands well and safely, and has less tendency to spin round on the ground after landing. On single-engined aeroplanes built for war purposes, the undercarriage has usually been fitted to the fuselage unit, which has more or less settled the width of the track. For commercial aeroplanes a wide track should make them on the whole easier and safer to land.

The pilot can make a safer landing on soft ground by having his tires fairly soft so as to widen the effective tread.

To sum up, it is suggested that the vertical distance from the wheel axis to the C.G. and thrust line should be kept to a minimum; that undercarriages should be made capable of absorbing side shocks to a much greater extent; that the desirability of good shock-absorbing properties is in no way lessensed by a necessity for ground feel in landing; and that on commercial aeroplanes tandem wheels combined with the widest wheel track possible will make for safety and ease of landing.

(*To be concluded*)

(*Continued from page 299*)

the balance and observes the deflection of the horizontal and vertical arms. When the air current is not horizontal there is an inaccurate resolution of the components and, since the drag is relatively small and the lift large, an error in the drag, through a lift component, is very important. We accordingly make control measurements: One with the convex side of the aerofoil up, and the other with it down. If both measurements are not the same, the cone is not properly adjusted.

Fig. 4 shows an arrangement which we have employed (especially at first, before our experimental arrangements were entirely completed) in measuring simple resistances. The model hangs on vertical wires. The wire underneath, with the weight, serves to hold the measuring wire taut. The latter branches, in the cone, into two wires, whereby the resistance to be measured is resolved into two forces in these directions. One wire goes to a balance above the cone where the force can be measured. We have employed this device especially for hanging full-sized objects in the air current and measuring their resistance. Various published data were obtained in this manner.

The entrance cone is made of wood, lined with sheet-iron and supported externally by a light iron framework, with which the diagonal adjusting rods are connected. The larger end of the cone is supported by a cast-iron rim in the wall. Excepting the part between the entrance cone and the blower, which is made of wood and iron, the tunnel is made of reinforced concrete, which has proved very satisfactory. Even the deflectors are made of reinforced concrete and simply brought into position with a crane and walled in.

A measuring device serves for measuring the speed distribution in the air current, for testing its uniformity, on the one hand, and for determining the speed in the vicinity of the object on the other hand. This device is comparatively new and only a few tests have yet been made with it. Otherwise I would have shown you a diagram of the uniformity of the air current. The reason I do not do so is chiefly because our recording manometer must be reconstructed in order to do really accurate work. I expect, however, to be able to do so at our next meeting. On a car which can run horizontally on the wooden rails there is a tower on which a second car runs in a vertical direction. Through the latter runs a rod on the end of which is a pressure gage. Thus all points can be reached. By means of a pressure recording device a line is drawn for either the horizontal or vertical direction.

Fig. 5 shows a device that is located under the floor of the experiment room. (In Fig. 4 this space is left empty, corresponding to its condition at the beginning of 1917.) This is a very noteworthy object, consisting of a turntable with floats and a trap. When the experimental apparatus is wheeled in it cannot be left on wheels, but must rest on stationary supports, since only thus can accurate weighings be made. Hence it is necessary to have some special provision for supporting the heavy apapratus which weighs from 500 to 1,500 kg. We have hit upon the expedient of lowering the central portion of the track on four spindles. These may be either outside the turntable or even on the turntable, if necessary, whereby the entire measuring apparatus can be swung through a moderate angle (so that, for example, a propeller can be tested in an oblique position with reference to the air current).

(*To be concluded*)

NAVAL and MILITARY AERONAUTICS

General Menoher Heads First Division

Maj.-Gen. Charles T. Menoher, formerly Chief of Air Service, has been assigned to command the First Division at Camp Dix, N. J., relieving Maj.-Gen. D. C. Shanks, who, under orders issued by the War Department, October 25, assumes command of the Fourth Army Corps Area, with headquarters at Atlanta, Ga.

Resumption of Recruiting for Air Service

The Air Service is in immediate need of over 3,000 enlisted men to fill existing vacancies, and authority for the procurement of these recruits was contained in a letter from the Adjutant General of the Army, dated September 8, 1921, which outlined the procedure to be followed in securing recruits. Additional instructions regarding recruiting were subsequently issued by the Adjutant General in a series of recruiting letters.

Recruiting will again be conducted under the direction of Corps Area Commanders. Under this plan the Air Officer is the representative of the Chief of Air Service for all matters pertaining to recruiting for the Air Service within the corps area, and therefore the successful solution of the present recruiting problem is directly in the hands of the Air Officer. Each Corps Area Air Officer and the Commanding Officer of Bolling Field, Anacostia, D. C., has been directed to submit on December 31, 1921, a detailed report concerning recruiting activities for the Air Service within the corps area or district. Certain quotas have been assigned to various corps areas, but as these do not take into consideration current losses through discharge, it will be necessary from time to time to increase those quotas to compensate for such losses.

The distribution of the authorized strength of the Air Service by organizations is as follows:

Organization	*Strength of Organization*	*Number of Organizations*	*Total Strength*
Wing Headquarters	20	1	20
Group Headquarters (H/A)	35	6	210
Group Headquarters (L/A)	18	1	18
Squadrons	132	25	3300
Squadrons (R. S.)	90	10	900
Balloon Companies	130	3	390
Balloon Companies (Coast Defense)	100	8	800
Airship Companies	130	6	780
Air Parks	172	10	1720
Branch Intelligence Offices	5	6	30
Air Offices Casual Detachments	4	6	24
Photo Sections	20	13	260
Field Officers School	96	1	96
Photo School	51	1	51
Airship School	150	1	150
Pilot School	500	1	500
Gunnery Detachment	75	1	75
Mechanics School	100	1	100
Observation School	400	1	400
Balloon School	150	1	150
Flying Cadets	—	—	276
Communications School	50	1	50
			10,300

The following vacancies for enlisted men now exist at Air Service stations:

	Heavier-than-Air	*Lighter-than-Air*
Mitchel Field, N. Y.	479	
Aberdeen, Md.	3	33
Lee Hall, Va.		**84**
Langley Field, Va.	168	206
Montgomery, Ala. Air Intermediate Depot	33	
Carlstrom Field, Arcadia, Fla.	305	
Camp Knox, Ky.	55	
Scott Field, Belleville, Ill.		87
Chanute Field, Rantoul, Ill.	976	
Fort Riley, Kansas	110	
Brooks Field, San Antonio, Texas		166
Ellington Field, Houston, Texas	296	
Kelly Field, San Antonio, Texas	433	
Post Field, Fort Sill, Okla.	4	91
Rockwell Field, San Diego, Calif.	9	
*March Field, Riverside, Calif.	113	
Bolling Field, Anacostia, D. C.	95	

*For duty in Hawaii.

Post School at Kelly Field

In compliance with recent War Department instructions, a post school will be started at Kelly Field, San Antonio, Texas, on November 1, 1921. The following subjects will be taught:

Educational: Common School Branches.

Vocational: Automotive, Ignition, Carburetion, Transmission, Trouble shooting.

Business: Typewriting and clerical work (Army).

Communications: Radio, Installation, Operation.

Telephony: Installation and switchboard work.

Utilities: Carpentry and brick masonry.

This school is open to all enlisted men.

Chamber Gives Dinner In Honor of Capt. Mustin

The San Diego Chamber of Commerce gave Capt. Henry V. Mustin a farewell dinner at the San Diego hotel. Speakers of the evening included Admirals Welles and Burrage, William Kettner and E. B. Gould. Mr. Gould, president of the chamber of commerce, was toastmaster. The evening was enjoyed by everyone present.

Toastmaster Gould, after calling attention to the fact that Capt. Mustin is a citizen of Coronado, presented, on behalf of the chamber of commerce, a gold pencil to the retiring air squadron commander.

Flying in the Philippines

Commenting on the varied character of the country encountered by the aeroplane pilot on duty in the Philippines, the Commanding Officer of Clark Field, Camp Stotsenburg, Pampanga, P. I., states that flying throughout the islands is hazardous away from the airdromes. "The abundance of rice paddies, the uneven and heavily overgrown contour, now gently rolling, then abruptly mountainous, combine in presenting but few routes on which emergency fields are to be found. While in most rice sections in the States no very great hazard is encountered through emergency landings in the paddies, the local paddies are deeply terraced to overcome the unevenness of terrain. So far there is no record of a forced landing here in a cane field, but it is believed the heavy stalks would not prove an easier place to set the plane down than a paddy. While on the subject of the islands it is surprising to note the seemingly numerous localities which are little, if at all, known to white men. The peak of Mt. Pinatuba, approximately 12 miles airline from Clark Field, is said to be inaccessible, the sides of the mountain being sheer or extremely precipitate and the approaches heavily obstructed by tropical vegetation. It is also said that a tribe of Moro headhunters infest the region, which does not add to our enthusiasm for exploring too far afield in that direction."

Forest Patrol Operations from March Field

Forest fire patrols from March Field started on August 21, 1921. Two patrols were flown. The circle patrol, leaving the field daily, covers 185 miles and takes in San Gabriel Canyon on the northwest, Baldwin Lake on the east, and San Jacinto Mountain on the southeast. The Santa Barbara Patrol, leaving the field one day and returning the next, covers 215 miles one way. Fifty fires have been reported since the patrol started. The Air Service report was the first received on twelve of this number. On nine of the fifty the location was 100% efficient, twenty were 80% efficient, and two were missed entirely. The accuracy of the remainder cannot be determined, as they were unconfirmed at the time bi-monthly reports were submitted. Ninety-five per cent of the fires were reported within ten minutes of the time of discovery. The radio efficiency for the season was 95%, i. e., the ships were in communication with the ground 95% of their time in the air. The circle patrol was discontinued on October 27th, while the Santa Barbara patrol will be flown until November 15th.

New Airship Napoli Is to Eclipse Roma

Rome.—The giant airship Roma, which Italy sold to the United States Government, is looked upon as such a great success that the Italian air authorities are building another on much the same lines, only bigger and better, profiting by experience. It will be called the Napoli or Naples, and probably will be the second of a large fleet of air monsters.

The Roma measures 34,000 square metres; the Napoli will be 54,000. Like the Roma, the Napoli will be of the semi-rigid type. Her shape will be much the same as the sister airship though more elongated.

As in the case of the Roma, the car will be in the steel beams of the ship. It will hold a commandant's cabin with all necessary instruments, a passengers' cabin, a dining room, lounges and a kitchen run with electricity.

At the rear of the ship will be terraces for the passengers to admire the scenery at their ease.

There will be twelve Spa motors of 300 horsepower each, Italian designed and constructed. They are to be set tandem in the steel ribs in such a way that they can be repaired and even changed, if needful, during flight.

The Napoli will be able to carry a hundred passengers. With only four of its engines working its speed is expected to be forty-three miles an hour.

FOREIGN NEWS

Australia Refuses to Cut Aircraft Fund

Opposing a labor motion introduced in Parliament for the reduction of the air force appropriation, Premier Hughes declared November 22 that Australians "cannot yet rely overmuch on the Washington conference."

"The United States and Japan had launched new warships," he added, "while Great Britain, to show good faith, stopped building, throwing thousands out of work. Therefore it would be unwise to scrap our air force." The motion was rejected.

Plane Outspeeds Tempest in Night

A thrilling air race with a thunderstorm, with approaching darkness and a dwindling petrol supply, was the experience of Robert Barton, assistant general manager of the American Express Company in Paris, and Mrs. Barton, while flying in Spain. They arrived in Madrid safely in almost total darkness as their aeroplane engine gave its last gasps because of an empty petrol tank, but the storm broke on them so suddenly they were soaked through to the skin before they could reach the shelter of a hangar. They were in a De Haviland aeroplane piloted by Alan J. Cobham, who, it will be remembered, late last year made the long distance commercial airflight record by flying over all the European countries in six weeks, travelling 4,500 miles in all.

Cobham, who was delivering the aeroplane to a Spanish firm which is in commercial aviation between Seville and El Araish, on the Moroccan coast, took Mr. and Mrs. Barton as passengers. She had never flown before. After four flying hours they passed the night in Bordeaux. The next day they passed down the French coast and flew to San Sebastian and then over the Pyrenees to Victoria. Beyond Aranda, over the Guadarrama Mountains, his petrol supply was exhausted and Cobham landed in a small ploughed field. He managed, however, to buy a little gasoline from a passing automobile. Then he took off safely for a thirty-five minute dash to Madrid, when he saw a storm headed toward him. He flew over a country where landing would have been dangerous when it was nearly dark and finally won out. The Bartons were thrilled and greatly pleased over what was to them an adventure.

Cobham had delivered three De Haviland aeroplanes from London to Madrid without accident and inaugurated the first Spanish air service, which is now called the only punctual means of flying in Spain. These aeroplanes are operated with English pilots and mechanics, making in two hours a trip which previously required between seven and fourteen days.

Second International Aero-Exhibition at Prague

The Czechoslovak Aero Club organized in the days from 22nd to 30th of October, 1921, under the patronage of the President of the Czechoslovak Republic, Dr. Thomas Garrigue Masaryk, and under the assistance of the Government its second international aero exhibition at Prague. The success of the exhibition was secured owing to the participation of numerous inland and foreign exhibitors, further owing to an efficient propaganda and last but not least to the careful arrangement of the exhibition. Notwithstanding the mobilization, the exhibition remained open.

A considerable part of the obtained good results have without any doubt the air of politics of Czechoslovakia. Such intensive and foreseeing activity in matters of aviation could not be found in any other new State of central Europe, the policy of this Republic being the maintenance of the primacy in aviation among all these States.

The exhibition was again held at the Palace of Industry in the Exhibition Ground at Prague, area 10,000 square meters, and besides a great participation of the public, several official delegations from foreign States visited the exhibition and have shown a remarkable interest in the exhibited machines and engines.

The exhibition has been inaugurated by the Minister of Public Works, Tucny, who accentuated that the Government appreciates fully the work of the Czechoslovak Aero Club and will spare no means and efforts for the development of aviation in the country. The exhibition has been visited by President Masaryk, who expressed his satisfaction on the progress of the home aircraft industry, and by several Ministers, among whom the Minister of National Defence Udrzal, the Generals Syrovy, Cecek and others.

From the exhibiting firms, we may mention:

The "Compagnie Franco-Roumanie de Navigation Aérienne," which is running the air transport service between Paris-Strassbourg-Prague Warsaw, exhibited a limousine commercial aeroplane Blériot-Spad with 260 h.p. Salmson engine.

The "Societá Anonima Fiat at Turin" exhibited a 300 h.p. radial 9-cylinder engine and a 400 h.p. 8-cylinder engine in V-form.

The "Aero" aircraft works Prague exhibited a chaser "Ae.0.2" (design Vlasák-Husník) with 220 h.p. motor Hispano-Suiza, a chaser "Ae.0.3" (design Engineer Rösner) with Hispano-Suiza engine, and a chaser "Ae.0.4" (design Vlasák-Husník) with 185 B.M.W. motor.

The "Avia" Works Prague-Vysocan exhibited: a sporting monoplane, two-seater "Avia B.H.1" (design Benes-Hajn) fitted with a 48 h.p. Gnome, a sporting monoplane "Avia B.H.2" (design Benes-Hajn), 20 h.p. motor; a chaser monoplane "Avia B.H.3" (Benes-Hajn), fitted with a 185 h.p. B.M.W. motor.

The Military Aircraft Works Prague-Gbely exhibited a fighter two-seater biplane Sm.2 (design Smolík), 260 h.p. Maybach engine.

The "Ardea" factory exhibited a school monoplane "B.P.1" fitted with 70 h.p. Mercedes motor.

Air Lines in Winter

In an interesting article in the *London Observer*, Major C. C. Turner discusses Airlines in Winter as follows:

The new system of subsidies to approved British companies using approved aeroplanes on the London-Continental services, which was to have come into operation this month, is delayed until February. Four firms have been approved, three for the Paris and one for the Brussels line. The terms of the new subsidies as published last June have been modified in favor of the firms; and they are even now regarded as ungenerous by some. On the other hand, at least one of the companies has expressed satisfaction.

Interesting points are raised in discussion of these matters. A common impression that the whole of a sum allocated for subsidies is necessarily expended is erroneous. The subsidies are partly proportionate to revenue; and, as a matter of fact, some of the £50,000 set aside last March has not been spent. The system on which it was laid out will be continued through the winter.

It should be remembered that the amount of traffic is limited, and that the subsidies only apply to firms running from England to the Continent. As a consequence, the grant is not likely to be used up; and when the traffic is split up between four firms, as it will be, it is perfectly clear there is not much in it for any one of them. That is one of the complaints; it is urged that the Air Ministry should have approved of no more than two firms, or that in order to avoid any suspicion of giving a monopoly it should have called together a national corporation representing the whole industry to run the services.

Again, it is clear that taking the services on successes achieved during a very fine summer is unfair; they must be judged on an all-the-year-round basis. During the summer there have been times when there were too many passengers for the machines. Now the number of passengers is falling off, and the companies are realizing that freight of a less fluctuating character would be desirable.

Unfortunately, from the first passengers were regarded as the main business, and mails and parcels as secondary. The present writer has all along contended that mails should be put first, and passengers as a variable quantity.

Air mails have not been encouraged as they ought to have been, yet they could make up a steady volume of paying freight all the year round without noticeably encroaching upon existing railway interests. And mails are more remunerative than passengers. A passenger weighing with his luggage 180 lbs. is charged six guineas for a flight to Paris. Parcels are charged at 1s. per lb., so that 180 lbs. of parcels yield £9. It would take 2,880 one-ounce letters to make up the same weight; and if out of the 3d. fee one penny was set aside for the cost of air transport from Waddon to Le Bourget the yield would be £12, leaving a further £24 for the cost of collection, delivery, and road transport. Of course, there would not be enough mail to fill up several big machines every day. But if the Post Office would co-operate to the extent of handing over a definite quantity most of the present difficulties would be met.

Limiting the air-lines to the south-east corner of England has, as the writer foretold, had a crippling effect. The organization has had to be built up, but there has been no encouragement of quantity production of machines. Had the Post Office been asked by the Air Ministry two years ago to co-operate for the encouragement of inland air lines the actual cost of air transport would today be much less than it is. Besides which, there would have been in existence a big reserve for the Royal Air Force.

The Post Office would have had a right to demand reasonable regularity. This would be possible to achieve with existing knowledge and appliances; but it should be remembered that on the rare occasions when aeroplanes could not fly the mails would be diverted to the railway. After all, it would only be a small proportion of the total mails.

The Air Ministry repeat the opinion that for the present attention should be confined to the Continental lines. It may be doubted whether, all the while this view is taken, any progress will be possible.

Ex-King Karl and the Ad Astra Co.

As a sequel to Karl's recent escapade he has, according to a report to hand, had a couple of his motor-cars and about £1,500 standing to his credit in Swiss banks "sequestrated" on account of the Ad Astra Aero Co., of Zurich, who were the owners of the aeroplane which the ex-King "commandeered" to carry him to Hungary. A very pretty tit-for-tat.

Airships and the United States

Mr. Gilbert on November 2 asked the Secretary of State for Air in the British Parliament, whether it is proposed to offer the American Government another airship for the one that was unfortunately lost; if so, can he state what ship has been offered to them, when it is proposed to deliver the same, and at what air station; if such ship has been accepted by the United States authorities; and can he make any general statement on the subject?

Mr. Parker: The answer to the first part of the question is in the negative, and the remaining parts do not, therefore, arise.

The Fleet and Air Observers

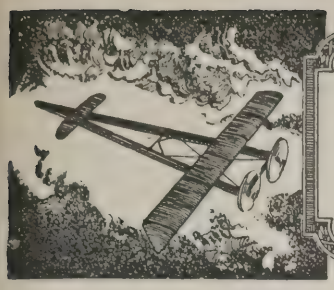
Upon similar lines to the specialist branches for gunnery, torpedo, navigation and signals, the British Admiralty have decided to make a specialist branch of the Air Observers among naval officers. For the present, eight officers will be selected each half-year. In time, only junior lieutenants of two years and upwards will be selected, as in other specialist branches, but a few commanders and lieutenant-commanders are required, immediately for training. Courses, each of seven months' duration, will begin in May and November in each year, and will include two months' preliminary training at the naval schools in gunnery and signals, and five months at the seaplane training school at Lee-on-Solent.

While under training with the R.A.F. officers will receive the full pay of their naval rank, with extra remuneration for each actual day of ascent, of 3*s.* in the case of commissioned and subordinate officers, and 1*s.* 6*d.* in the case of warrant officers. After qualifying they will be eligible for appointment as observers in aircraft carriers in the Royal Navy, and while actually detailed as trained observers will receive allowances of 4*s.* and 2*s.* a day respectively. If qualified in wireless telegraphy, these allowances will be increased to 6*s.* and 3*s.* a day. Officers will retain their naval rank and wear naval uniform while under training. On completing the qualifying course they will be rated probationary observers and appointed to fleet carriers for further training. On completing six months, including a course at Leuchars, Fife, they will be eligible for confirmation on the recommendation of the Commander-in-Chief of the Atlantic Fleet.

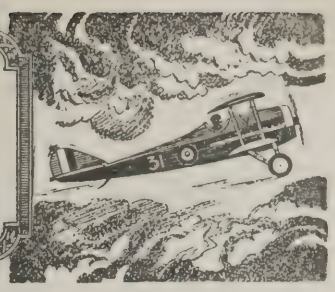
Avro-Sunbeams in Australia

Particulars are to hand of some performances of Avro commercial biplanes fitted with Sunbeam-Coatalen "Dyak" 100 h.p. engines, which are being produced in considerable quantities in Australia. Up to the time of writing, one machine has carried no less than 283 passengers in 111 flying hours, covering in that time a distance of over 7,400 miles, without mishap.

A similar biplane, the property of Mr. P. Hogarth, Clio, Queensland, made a trip of 1,845 miles in 20 hours' flying time, the average speed being 92.5 m.p.h. The engine gave no trouble throughout the whole of the trip, and the pilot never had a moment's anxiety. This flight was over very sparsely inhabited country, which would, in many parts, be practically impassable by motor-cars, and the value of such expeditious means of transport in such a country can scarcely be over-estimated. The owner of the machine in question, Mr. Hogarth, expresses himself that the aeroplane is the one and only practical means of transport for his district.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Some Notes Regarding Soaring Birds

SEVERAL years ago, in the course of his work in India, Captain H. S. Wildeblood (M. Inst. C. E., A. F. R. Ae. S.) made some interesting notes concerning soaring birds. Since very little of information of the character has been published before, his observations may prove of value to those studying the problem of man-carrying soaring machines and gliders.

To sum up his observations, the following points are worthy of consideration:

(1) Soaring birds seem to soar only when there is a perceptible breeze, and to prefer to soar in a strong wind.

(2) The theories of upward currents, pulsating winds and sun soarability, though not disproved by these observations, receive no support therefrom.

(3) Whether all, or any, soaring birds recede their wing-tips in order to obtain lateral stability is at present doubtful, though there is evidence that some of them do so when there is a strong wind blowing.

(4) Soaring birds appear to move the wing tips only, on the side which they wish to depress. This appears to prove that they rely on the use of the negative angle, on one wing tip only, for altering or introducing lateral cant, and that they do not move the other wing or wing tip for this purpose.

(5) The action in turning to right or left is not easy to follow, but is conceivably due to the use of the negative angle in a wing tip, which induces turning and canting simultaneously.

(6) Birds swoop down by receding their wing tips.

(7) It is obvious that a soaring bird, like the cheel, can, in a wind, reach any point he desires and at any height, without a single flap of the wings; he can travel for miles dead on to a gale, with no perceptible loss of height and he can, by circling, rapidly gain increase of height.

(8) These apparent phenomena are not adequately explained by any accepted theory of the present day.

(9) The matter is of great importance and will probably influence the future of flight to a much greater extent than any of us now recognize. It may indeed open up a way for the yacht of the air, if it can be solved, and the possibilities in this direction are boundless.

(10) As a basis for discussion the following tentative theories are proposed:

a—That within certain angles of incidence and at certain relative air speeds, the resultant wind force acting on a soaring bird is inclined forward at an angle with the vertical; and that this enables the bird to travel forward against a strong head wind with no loss of height.

b—That in order to gain rapid increase in height the manoeuvre of circling is adopted and that this consists, broadly speaking, of a sharp run down wind at a small angle of incidence with very little loss of height and of a rush up wind at an increased angle of incidence with great increase of height. In order to prevent loss of position relative to the earth, the bird manoeuvres in accordance with theory (a) during part of the time that he is facing the wind.

In order to gain height rapidly it is necessary for soaring birds to circle. The gain of height on the up wind side of the circle is far greater than the loss of height, if any, on the downward side, the former being very evident and the latter imperceptible.

While the bird is circling, his inner wing tip is lower than his outer, except when he is facing the wind. He is then horizontal or nearly so. His greatest cant, or lateral angle of inclination, in circling is usually about forty-five degrees or so.

A rather clumsy looking vulture which was observed to be gaining height in circling was seen to lose ground rapidly, that is, he was drifting to leeward with each circle, and that each time he faced the wind, though he gained height, he was pulled up rapidly and had to turn. A cheel in the vicinity was getting along much more smoothly. There is some virtue in the act of circling which lifts the bird up rapidly whereas a bird heading against the wind for a long time cannot gain height to any appreciable extent, if at all. In circling, the bird certainly gains velocity when gliding down wind. As soon as he faces the wind he is visibly carried upwards by it, though his drop in gliding down wind has not been noticeable.

The cheels can float about with, across, and against the wind with very little, if any, loss of height and with a very small, if any, angle of incidence of the wings. They are able to lie on the wind, facing it, without advancing, sometimes receding a little, and without either rising or falling perceptibly. They can advance indefinitely against the wind with no apparent loss of height, but in doing so they cannot gain height rapidly, as they do in circling.

From these observations it appears that the resultant wind force acting on them is nearly vertical and may even be inclined forward slightly, so that backward drag is eliminated, and there may even be a slight forward component in its place when a cheel is floating on a wind of considerable velocity and facing it at a very slight, or zero, or even negative angle of incidence, the latter being understood to be the inclination to the wind of a line drawn from leading to trailing edge of the cambered part of the wing.

If the resultant wind force is inclined forward and if it is of such force and inclination that its vertical component is sufficient to overcome the bird's weight, while its component facing the wind is sufficient to overcome the resistance of the bird in that direction, or its drag, the apparent phenomenon of the bird advancing indefinitely against a strong wind without loss of height is explained.

(*To be continued*)

Two More Records Broken By the I. M. A. C.

In the Illinois Model Aero Club's last meet of the year (September 25, 1921) two records were broken—the hand launched twin pusher for duration, which was raised to 265 seconds, and the "rising-off-ground" for the same type of model now stands at 209.4 seconds. Both these records are claimed by Robert Jaros.

At the club meeting of October 7th, Major R. W. Schroeder gave a most interesting talk on his altitude flights and the Gordon Bennett race.

The annual banquet and other indoor activities will keep the club members busy during the cold months.

A Glider-sled of Novel Design

A report has reached this country that an enterprising manufacturer in Germany has put into production an ingenious glider-sled which will be sent in quantities to the United States. It is said that the features of this device are a pair of very efficient monoplane wings, of rather short span, projecting from either side of a rather conventional coasting sled.

The idea is not new, but it appears to be practically developed and should provide a good deal of sport for skillful coasters. The wings are so arranged that, when a good speed has been attained in coasting, they may be tilted so as to lift the sled right off the ground and continue in the air for quite a distance, depending, of course upon such considerations as the weight of the rider, the smoothness and steepness of the hill, etc. The principle could be used to advantage by experimenters in soaring flight and gliding flight, for the most difficult part of such experiments is to get the initial speed to start—this idea seems to possess good points in that respect, and because of the greater safety to be found in landing in snow rather than on hard earth.

Would Promote Gliding Contests

Efforts are being made by W. H. Logue, Jr., 931 North Broadway, Baltimore, Md., to arouse interest in national competitive gliding contests.

The success attending experiments with motorless aircraft in France and Germany, said Mr. Logue, has brought home a realization in this country that no advancement has been made in the United States with regard to such steps. In Baltimore, he said, are many young men who should be able to take an active interest in a craft capable of remaining aloft without an engine.

Young men in Baltimore (and in other cities also) are invited to communicate with AERIAL AGE in regard to such contests, and efforts will be made to cooperate with them for the purpose of establishing a basis upon which satisfactory contests can be arranged.



The Knocker

When the Creator had made all the good things there was still some dirty work left to be done, so he made the beast, the reptiles, and the poisonous insects, and when he had finished there were some scraps left over that were too bad to put into the rattlesnake, the hyena, the scorpion and the skunk, so he put all these together, covered it with suspicion, wrapped in jealousy, marked it with a yellow streak and called it a *Knocker*.

This product was so fearful to contemplate that he had to make something to counteract it, so he took a sunbeam, put in the heart of a child, the brain of a man, wrapped these with civic pride, gave it a mask of velvet and a grasp of steel and called it a *Booster*. Made him a lover of fields and flowers and of manly sports, and a believer in equality and justice, and ever since these two were made *The Knocker* and *The Booster*—mortal man has had the privilege of choosing his own associates.

A Sailor's Lament

If my wish could be granted
From Somewhere overhead,
I'd wish to be an oyster
And always stay in bed.
—*Golden Gate Sentinel.*

OFFICER (*drilling recruits*): Hey, you, in case of fire, what do you do?

RECRUIT: Yell.

OFFICER: Yell what?

RECRUIT: Why, what do you suppose? Cease firing.
—*Blue Hen Weekly.*

That Grand and Glorious Feeling

Didya ever get up in a ship and when you're high enough so that you can be trusted, the instructor says, "She's all yours," and you take the stick and try to give her enough right rudder to overcome the torque and by that time the nose is either up or down or the wings aren't level, and by the time you correct those minor details she is drifting off sideways, somewhere, didya? And after you sweat blood for a while and go from rotten to rottener, the instructor grabs the stick and sets her level and directs you, in the name of all that's holy to keep her that way, and you don't and he makes a few choice remarks as to the amount of gray matter you are endowed with, and the horizon gets the St. Vitus dance, and the wings absolutely refuse to stay put, and the instructor tells you you are a goof, which is superfluous, because you've known that for some time. Just about then your instructor's remarks are hot enough to scorch the tail surfaces and you wish you had a transmitter on the Gosport phone so you could come back at him and you resolve to hide it somewhere tomorrow; didya ever notice that just about then you get mad and pull yourself together and manage to hold her level for a minute or two and you find it's not so bad after all. Just then, if your instructor nods his approbation, Oh, Boy, ain't it a gran' an' glorious feelin'?—*Carlstrom News.*

A Freshman just in from Hong Kong
Bought a race-about Ford for a song.
The tires weren't new
And the spark plugs were two
But you should have seen Hong tear along.

Friend, to driver of Ford (after narrow escape at crossing); "Why didn't you insist on your right of way with that car? If the case went to court, they wouldn't have had a leg to stand on."

"Neither would we."

FIRST SWITCHBOARD OPERATOR: What did you say to that shimmie artiste?

SECOND S. O.: Looks as if all trunk lines were busy.

Walking On Air

"Have you seen the tight rope walker?"

"No; where did he get it?"—*Widow.*

HALF: That coach is a wonderful conversationalist.

BACK: He ought to be—he spends the whole season improving his line.—*Banter.*

I kissed a girl on her soft, white hand,
I said her heart was hard.
I kissed that girl on her soft red lips,
Gosh, but her hand was hard.
—*Harvard Magazine.*

"Why is a woman like an umbrella?"

"Oh, go on, tell me quick."

"Well, every man ought to have one and not borrow his neighbor's."—*Mugwump.*

Academic Training

A wealthy Irish farmer, intending to send his son to college, wrote a letter to the "Head Master of Oxford University," in which he said: "Please say what are your terms for a year; and will it cost anything extra if my son learns to write a good hand and spell proper, as well as to row a boat?"
London Weekly Telegraph.

Nothing But the Truth

LAWYER: And what was the defendant doing meanwhile?

WITNESS: He was telling me a funny story.

LAWYER: Remember, sir, that you are under oath.

WITNESS: Well, anyway, he was telling me a story.
Pearson's Weekly (*London*).

Offn 'Em for Life

Times were hard and Mrs. Johnson was endeavoring to get her lord and master to enter some gainful occupation.

"It's a good job," she argued. "Fo' and a half dollars fo' eight hohs a day."

"Who dis man, tryin' to th'ow money at me dat way?"

"Tom Wilson."

"Tom Wilson? No, ma'am; somebody else, not me. Ah done wo'k two yeahs in France fo' dat Wilson family."
—*Legion Weekly.*

Still a Chance

Caddie (to golfer badly bunkered, with opponent well on the green): Don't give up the hole, sir. You never know; the other gentleman might have a fit.—*Boston Transcript.*

He Had His Doubts

An elderly man was persuaded by one of his sons to go with him to a boxing exhibition.

The son paid for two $2 seats.

"Now, dad," said the son joyfully, "you'll see more excitement for your $2 than you've ever seen in your life before."

The old man grunted.

"I've got my doubts about that," he said gloomily. "Two dollars was all I paid for my marriage license."

Of Course

Some poker players claim that they
Are lucky as can be,
But a manicure holds bigger hands
Than many that we see.
—*Los Angeles Examiner.*

The Balancer

Scorn, if you will, the lowbrow how,
Aye with a knife his peas doth eat;
But give the devil his just due;
Admit—it is a dextrous feat!
—*Judge.*

"Recently there appeared in a country weekly the following advertisement: 'If John Jones who deserted his wife and baby some 20 years ago, will return, the said baby will knock the stuffing out of him.'"—*The Shield.*

A Sad Case

NORTH: Webster was injured in government service.

WEST: Wounded in the war?

"No. He worked in the rehabilitation department and fell out of his desk chair while asleep."
—*New York Sun.*

AERIAL AGE WEEKLY

DEC 11 1921
LIBRARY

OL. 14. No. 14 DECEMBER 12, 1921 10 CENTS A COPY



A Magnificent Private Residence and Estate Photographed by the Fairchild Serial Camera Corp.

The Paris Aero Show—Admiral Sims on Aircraft—The Eggleston Air-Cell Giant Biplane

SHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
iptions: Domestic, $4; Foreign, $6. Entered as secon-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

MADE IN ITALY—USED THROUGHOUT THE WORLD

Ansaldo S. V. A. Aeroplanes

Reliability—Speed—Economy

TO

AMERICAN ANSALDO ACHIEVEMENTS

ADD

FIRST PLACE—LARSEN EFFICIENCY CONTEST:

Winner Larsen Trophy and $3,000 cash. Model Nine two place SVA flown by Capt. E. F. White, carrying a useful load of 1,161 pounds first, junkers second and third.

FIRST AND THIRD PLACES AMERICAN LEGION DERBY:

First, Winner Legion Trophy and $3,000 cash. Ansaldo Curtiss Balilla flown by Lloyd Bertaud.

Third, Model Nine SVA, flown by Capt. Earl F. White.

FOURTH PLACE PULITZER RACE, 1921

Ansaldo Curtiss Balilla.

Note: The SVA Model Nine which won the Larsen Trophy and placed in the Legion Derby is a stock model.

A Demonstration Will Convince You

AERO IMPORT CORPORATION

1819 BROADWAY NEW YORK

WRIGHT PATENTS LICENSEE

December 12, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 14

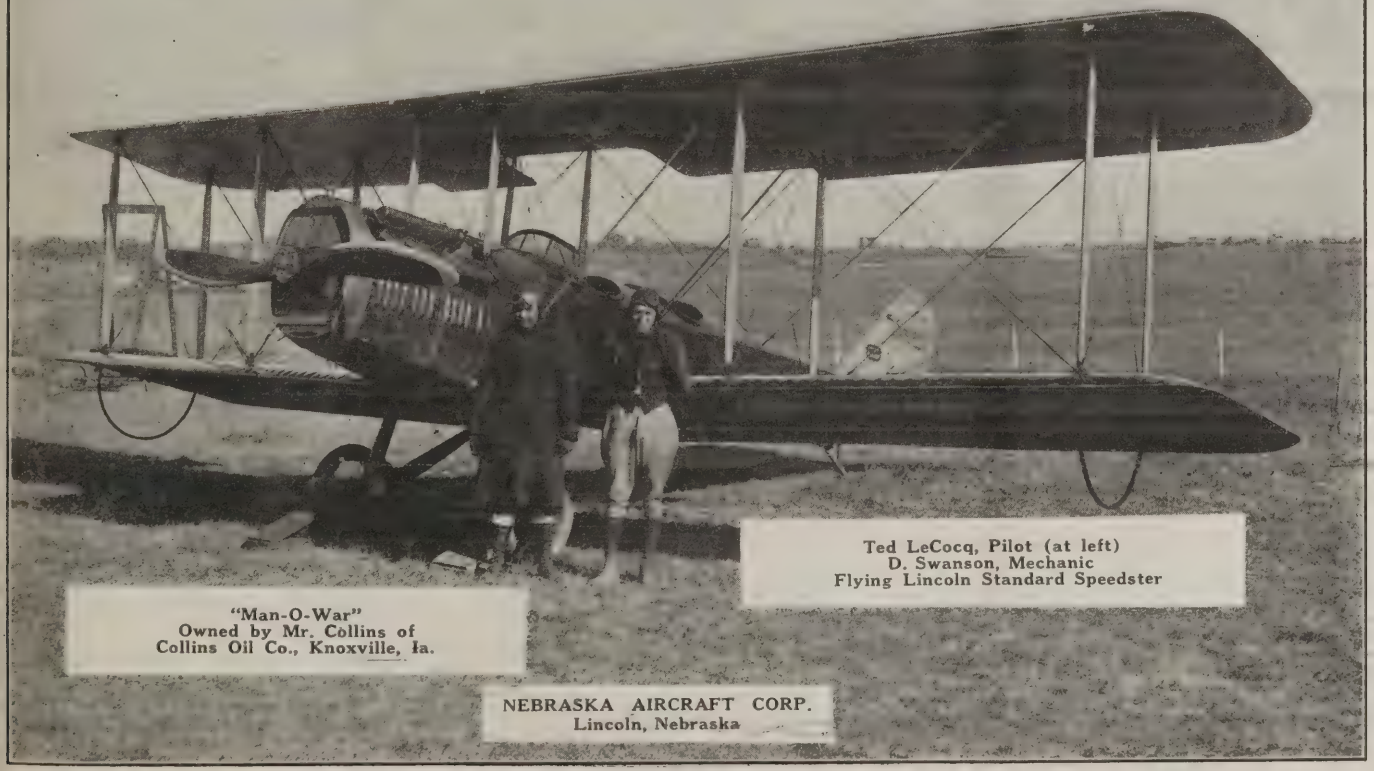
TABLE OF CONTENTS

Admiral Sims on Aircraft..... 315
The Abandoned Naval Reserve.... 315
The News of the Week..... 316
Pulitzer Trophy Race 317
Larsen Trophy Race 317
The Aircraft Trade Review..... 318
The Paris Aero Show..... 319
Aerodynamical Report and Tests on the Eggleston Air-Cell Giant Biplane 323
Göttingen Wind Tunnel for Testing Aircraft Models 324
Naval and Military Aeronautics.... 327
Foreign News 328
Elementary Aeronautics and Model Notes 329
Aeronitis 330

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

This Pilot says:
"I have flown the Lincoln Standard over four States and consider it the best ship on the market. Its ability in tight places is wonderful."

Price $3985
F. O. B. Factory



Ted LeCocq, Pilot (at left)
D. Swanson, Mechanic
Flying Lincoln Standard Speedster

"Man-O-War"
Owned by Mr. Collins of
Collins Oil Co., Knoxville, Ia.

NEBRASKA AIRCRAFT CORP.
Lincoln, Nebraska

Curtiss



WORLD'S RECORD

"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

CURTISS AEROPLANE & MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., December 12, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, DECEMBER 12, 1921 NO. 14

Admiral Sims on Aircraft

THE joint Army and Navy Board, reporting upon the aerial bombing tests off the Virginia Capes, declared that "the battleship is still the backbone of the fleet and the bulwark of the nation's sea defense." If an address just made by Admiral William S. Sims, President of the Naval War College, is correctly reported, he took issue with the joint Army and Navy Board and squarely disputed its conclusion. "The battleship," he is quoted as saying, "is no longer the backbone of the navy. The battleship has no defense against aeroplanes and no offensive power against aeroplane carriers which have speed enough to keep away."

In the proposals of Secretary Hughes for limiting naval armaments an aeroplane carrier allowance of 90,000 tons was fixed for the United States and Great Britain, and 54,000 tons for Japan; but no attempt was made to restrict aeroplane construction. The limitation of naval aircraft was considered impracticable, since naval aircraft could be readily adapted "from special types of commercial aircraft." As the army bombers that sank the former German dreadnought *Ostfriesland* flew at least one hundred miles from an inland aviation field to attack the warship, it seems to have been demonstrated that no hostile fleet could venture to approach near the coast of a nation strong in commercial aviation. The joint board evidently recognized this, for it said that if the navy commands the sea routes, the lines of traffic can be kept open without entering the area of the enemy's coast zone which is controlled by aircraft bases on shore. The report went on to say that if heavier-than-air craft were to be effective in naval warfare they must operate from carriers.

It was then contended that as carriers could be attacked by vessels armed with guns, torpedoes or bombs, they would have to call upon the battleship for protection eventually. This was reasoning in a circle, and was really an avoidance of the question whether, on the offensive, aircraft would not be superior to the battleship in destructive power. Admiral Sims has been quoted above.

The greatest speed of British battleships is 25 knots. The maximum speed of any American battleship in commission is 22 knots, which the *Florida*, a 12-inch-gun ship, has attained. Our most powerful battleship, the *Maryland*, was built to steam 21 knots, but has exceeded it somewhat on her trials. Thirty-five knots for an aeroplane carrier is feasible. It has been said that a carrier of 30-knot speed could keep out of the range of any known gun of a battleship and launch her bombing planes to attack the battleship. A satisfactory defense aga nst aeroplanes may be devised, but none exists today. So it comes to this: granting that carriers themselves might succumb to attack from the air and from torpedoes launched by submarine or destroyer, the battleship would always be in danger of destruction in mid-ocean so long as the swift carrier kept the sea.

Admiral Sims's conclusion is stated to be that the nation controlling the air will control the surface below, and that supremacy in the air will determine victory. He shares this view not only with French and British naval officers, but with officers of high rank in our own service. The question arises whether the conference at Washington will not eventually be forced to go deeper into aircraft limitation.—*Editorial in N. Y. Times.*

The Abandoned Naval Reserve

EXPERTS disagree as to the possibility of a "next war," but they agree absolutely that if the next war does come, it is likely to be on the seas and in the air. We are warned that we must have adequate naval and air forces. We must have adequate reserves. Yet in spite of these warnings, the paid personnel of the Naval Reserve Force has shrunk in the last few weeks from 230,000 to nothing. The Naval Reserve, in which hundreds of thousands served faithfully and valiantly during the war, has practically been abolished by Congress, which failed to appropriate enough money to pay the meager retainer fees of personnel. The Navy Department, asserting that it had no alternative, discontinued the paid reserve. All members were disenrolled, having only an opportunity to join Class 6 of the reserve, a class in which personnel is not paid no matter how much time may be devoted to drills and maneuvers.

Thousands of reserve sailors went on cruises this summer at Navy expense, receiving only Navy pay and training, which is more valuable to the Navy than to the reserves. To disenroll these men is to waste their summer's work, yet they have been disenrolled.

Toward the close of the world war, thousands of men joined the Naval Reserve who were trained after the Armistice. All that training seems lost to the Navy. Many reserves recently "shipped over" after expiration of their enrollment. Good intentions have not been considered.

The Navy appreciates the Reserve Force. The reserves appreciate that the Navy needs them. Only Congress seems unaware that there is in time of war a need for trained sailors outside for permanent forces.—*American Legion Weekly.*

The News of the Week

Helium a Success in Airship Tests

Norfolk, Va.—By three flights with her bag filled with helium, the big navy dirigible C-7 has proved that the newly discovered gas can be used by lighter-than-air flying machines. Helium is non-inflammable.

The C-7 was up in the air twice Dec. 1 and once Dec. 2. She was scheduled to fly to Washington, but the weather interfered. The big blimp came to earth when it began to rain. The C-7 will fly to Washington, where she will be inspected by Assistant Secretary of Navy Roosevelt and by all the ordnance experts of the army and navy.

The C-7 was piloted by Lieut. Commander R. F. Wood, in charge of lighter-than-air work at the base. On the first flight there were also aboard Lieut. Commander Zachary Lansdowne and Lieut. C. E. Bousch of the Bureau of Aeronautics of the Navy Department and Chief Machinist Mate Farriss, who was engineer.

The helium used in inflating the C-7 is the product of the Government's plant at Fort Worth. Helium can be made in commercial quantities only from the oil obtained from certain wells in Oklahoma and Texas fields, and the United States, if necessary, can prevent other nations from obtaining it and thus possess great military advantage over them. The plant at Fort Worth, which cost several million dollars, was built during the war and is now under the joint operation of the army and navy. Helium is separated from the other gases in the oil by means of complicated refrigerating apparatus and the process is costly.

Helium has 92 per cent. of the lifting power of hydrogen and does not escape so readily. Though blimps are made of practically air-tight material, considerable gas seeps through and goes to waste. Helium is but 62 per cent. as diffusive as hydrogen. It has also the advantage that it does not deteriorate so rapidly. When hydrogen is kept long in a blimp it becomes impure and must be released. Helium does not absorb impurities so rapidly.

Spain to Argentina Air Line Projected

The Spanish Parliament is practically certain to sanction very soon the granting of a subsidy to an air company operating passenger and mail Zeppelins between Cadiz and Buenos Aires, making the trip between the two cities in ninety hours, according to an announcement by Dr. Hugo Eckner, manager of the Zeppelin works in Friedrichshafen, who has just returned to that city after a tour of South America, during which he studied conditions as applying to an air service.

The enterprise is purely Spanish, but the organization and management will be German.

Dr. Eckner declared that war experiences were such as to enable his company to guarantee the smooth operation of airships of 45,000 cubic feet in size at a rate of speed of seventy-two miles an hour while carrying between thirty and forty passengers and 300,000 letters.

The idea of the Cadiz-Buenos Aires service originated in Spain, he said, the Spaniards being anxious to establish a quick and direct connection with Spain's one-time trans-Atlantic children. Spanish negotiations with the Zeppelin management led to the organization of a commission, which has already provided 50,000,000 pesetas (about $10,000,000) of the necessary 80,000,000 pesetas (about $16,000,000), the Spanish Government guaranteeing the interest on this sum.

Speaking before the Argentine Aero Club and the German Club in Buenos Aires, Dr. Eckner emphasized the point that danger from thunderstorms and lightning did not exist for airships, since they were able to dodge tempests. He declared that excellent wind and weather conditions greatly favored the route proposed, which is 6,000 miles long.

The return journey from Buenos Aires to Cadiz will require a hundred hours, owing to the northeast winds that will be encountered.

Dr. Eckner said there were favorable terrain conditions at both ends of the route, particularly in Spain, which will facilitate hangar building. He expects that the entire capital stock of the company will be earned within two years.

It is proposed that the service will be inaugurated with three airships, which will cost 36,000,000 pesetas (about $7,200,000), and hangars, gas factories and wireless installations, costing 40,000,000 pesetas (about $8,000,000), while unforeseen expenses are calculated at 4,000,000 pesetas (about $800,000).

The expense in connection with each trip will be about 42,000 pesetas (about $8,400), and it is estimated the receipts will be about 900,000 pesetas (about $180,000) based on carrying sixty passengers at 5,000 pesetas (about $1,000) each, and 300,000 letters at 2 pesetas (about 40 cents) each.

New Plane Tested

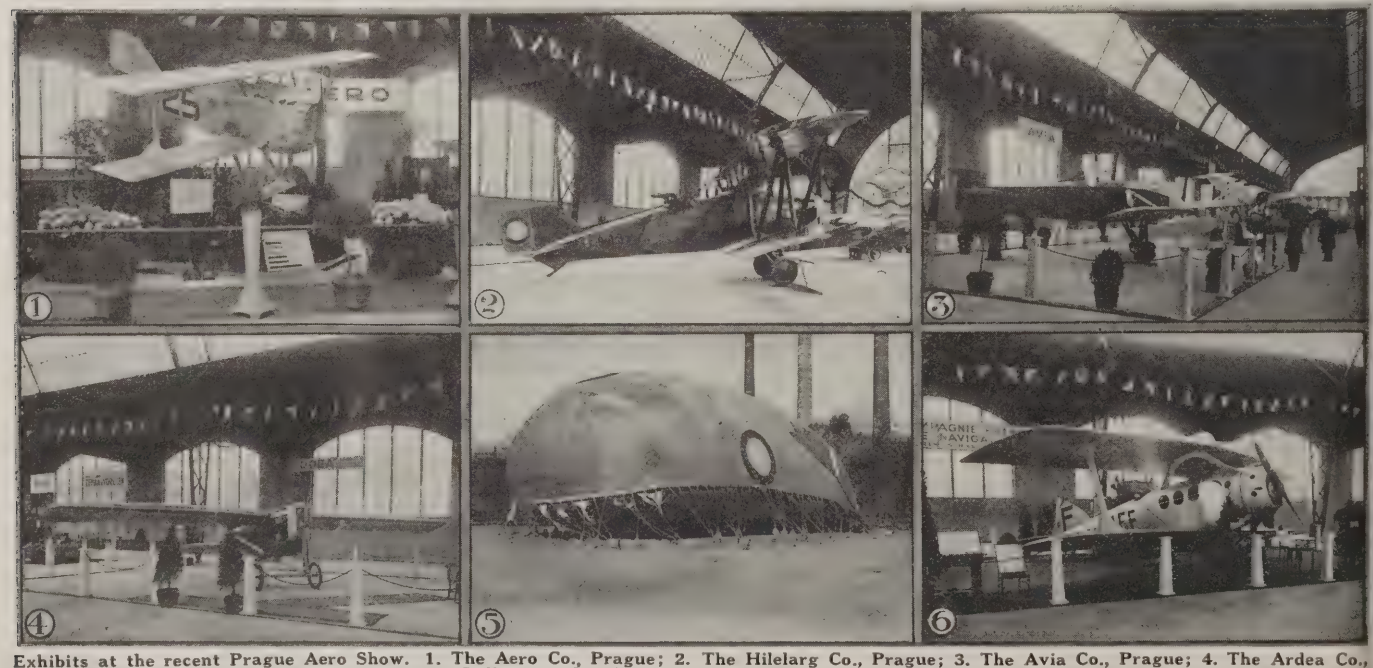
The Davis-Douglass torpedo plane, built in Los Angeles, was given a number of preliminary trials by the Fleet Air Force Monday. The ship is equipped with a 400-horsepower Liberty engine and embodies a number of new features in torpedo-plane construction, particularly the shape of the wing sections and manner in which the torpedo is carried and fired.

91st Aero Squadron Will Get New Planes

Twenty military airplanes have been ordered from the aeronautical supply base at Rockwell Field for the fliers of the 91st Aero Squadron based at Crissy Field, San Francisco.

The planes include two British spads, two British S. E. 5's, ten De Havilands and six Curtiss training ships equipped with Hispano-Suiza motors.

Officers of the 91st squadron will go to San Diego from San Francisco to fly the ships to the northern field when they are ready.



Exhibits at the recent Prague Aero Show. 1. The Aero Co., Prague; 2. The Hilelarg Co., Prague; 3. The Avia Co., Prague; 4. The Ardea Co., Prague; 5. A Kite Balloon in the Show Grounds; 6. The Campagnie Francais Arienne

PULITZER TROPHY RACE

Course—Triangular, 30.7191 Miles
5 Laps—153.595 miles

CONTEST COMMITTEE REPORT
OMAHA, NEB., NOV. 3, 1921

PLACE	PILOT	NUMBER	PLANE	ENTRANT	1st LAP Time min.	1st LAP Time sec.	1st LAP Av. Speed m.p.h.	2nd LAP Time min.	2nd LAP Time sec.	2nd LAP Av. Speed m.p.h.	3rd LAP Time min.	3rd LAP Time sec.	3rd LAP Av. Speed m.p.h.	4th LAP Time min.	4th LAP Time sec.	4th LAP Av. Speed m.p.h.	5th LAP Time min.	5th LAP Time sec.	5th LAP Av. Speed m.p.h.	TOTAL Time min.	TOTAL Time sec.	TOTAL Av. Speed m.p.h.	MOTOR Type	MOTOR H.P.	Drive	Ignition	Propeller	Carburetor	Oil	FUEL Gasoline	FUEL Benzol	Spark Plug	INSTRUMENTS Tachometer	INSTRUMENTS Altimeter	INSTRUMENTS Speed Indicator	TIRES
1	Bertrand Acosta	4	Curtiss Navy Biplane	Curtiss Co.	10	32.8	174.76	10	24.4	177.11	10	23.2	177.45	10	22 4	177.68	10	25.6	176.76	52	8.4	176.75	Curtiss CD-12	400	Direct	B'rkshire Magneto	Curtiss	Stromberg	Castor	50%	50%	A C	Army Type D	Fox-boro	Sperry	Good-year
2	C. B. Coombs	3	Curtiss-Cox Triplane	S. E. J. Cox	10	41.8	172.31	10	43.0	171.98	10	57.2	168.27	10	52.0	169.61	10	52.2	169.56	54	6.2	170 34	Curtiss C-12	400	Gear 3 to 5	B'rkshire Magneto	Curtiss	Stromberg	Castor	50%	50%	A C	Army Type D	Fox-boro	Sperry	Good-year
3	J. A. MacReady	2	Thos. Morse MB-6 Biplane	Thos. Morse Corp.	11	31.2	159 99	11	23.8	161.73	11	28 2	160.69	11	27 6	160.83	11	29.6	160.36	57	20.4	160.72	Wright H-2	300	Direct	Dual Dixie	McCook Field		Woolfs Head 8	40%	60%	A C	Van Sicklen	Tycos	Pre-cision	Good year
4	Lloyd Bertaud	27	Balilla Biplane	Aero Import Co.	12	36 8	146 13	12	01.6	153.25	12	19.2	149.61	12	18.4	149.77	12	17.4	149.97	61	31.4	149.79	Curtiss C-12	400	Gear	Stand-ard	Curtiss 4-Blade	Stand-ard	Castor & Mobile-B	50%	50%	Mosler	Stand-ard	Sperry	None	
5	Jas. Curran	6	S. V. A. Biplane	Ralph Diggins Co.	17	38.0	104.53	17	11.6	107.20										34	49.6	105.85	S.P.A.	220	Direct					100%						
a6	H. E. Hartney	1	Thos. Morse MB-7 Monopl'e	Thos. Morse Corp.																			Wright H-2	300	Direct	Dual Sims	Thomas Morse	Stromberg	Woolfs Head 8	40%	60%	A C	Van Sicklen	Tycos	Pre-cision	Good-year

aForced landing on first lap near Loveland, Iowa, due to failure of fuel pump.
The above data is certified to be a true record of the result of the Pulitzer Trophy Race held Nov. 3, 1921, as taken from original reports of judges, timers, and other officials, made to the Contest Committee, and as accurately checked and accepted by such committee. The report of instruments and accessories used by contestants are believed to be correct. Any error in recording the instruments and accessories shown will be corrected and published upon proof that error has been made.
A. H. FETTERS, Chairman Technical Committee. IRA A. RADER, Chairman Contest Committee.

LARSEN TROPHY RACE

CONTEST COMMITTEE REPORT
OMAHA, NEB., NOV. 5, 1921

Course—Triangular, 30.7191 Miles
8 Laps—245.753 miles

Formula — $E = \frac{(W—T)\ S}{G}$

E = Factor of Efficiency
W=Total Load Leaving Ground—Lbs.
T=Light Weight of Plane + Water—Lbs.
W — T = Total Useful Load—Lbs.
S = Average Speed, M P H Actually Made.
G = Gallons of Fuel Actually Used.

Place	PILOT	Number or Symbol	PLANE	ENTRANT	TOTAL TIME Min.	TOTAL TIME Sec.	Av. Speed m.p.h.	E	W Lbs.	T Lbs.	W-T Lbs.	S m.p.h.	G Gals.	MOTOR Type	MOTOR h.p.	Drive	Ignition	Propeller	Carburetor	Oil	Fuel	Spark Plug	INSTRUMENTS Tachometer	INSTRUMENTS Altimeter	INSTRUMENTS Speed Indicator	TIRES
c1	E. F. White	8	S. V. A.	C. B. Wrightsman	154	56.0	95.17	4671	2772	1600.	1172.0	95.17	23.88	S.P.A.	220	Direct	2-Marelli	Ansaldo	Zenith	Woolf Hd. ex.hvy."A"	Gasoline	Mosler	Jaeger	None	None	Pirelli
2	Max Goodnough	O	JL-6	J. M. Larsen	151	41.4	97.21	4640	4164.5	2446.	1718.5	97.21	36.00	B.M.W.	185	Direct	Bosch	J.L.	B.M.W.	Mobile-B	Benzol	Mosler	Sperry	Foxboro	Special J. L.	Good-year
3	E. Stinson	No number	JL-6	J. M. Larsen	150	58.6	97.66	4212	4063.5	2446.	1617.5	97.66	37.50	B.M.W.	185	Direct	Bosch	J.L.	B.M.W.	Mobile-B	Gasoline	Mosler	Sperry	Foxboro	Special J. L.	Good-year
b4	B. H. Pearson	aY	JL-6	J. M. Larsen	Did	not	finish		4182.5	2446.	1736.5			B.M.W.	185	Direct	Bosch	J.L.	B.M.W.	Mobile-B	Benzol	Mosler	Sperry	Foxboro	Special J. L.	Good-year

aYellow ship.
bForced landing near Loveland, Iowa, on 6th lap, due to broken valve stem spring retaining washer; no other damage to plane.
cDecision appealed.

The above data is certified to be a true record of the result of the Larsen Trophy race held Nov. 5, 1921, as taken from original reports of judges, timers and other officials made to the Contest Committee, and as accurately checked and accepted by such committee. The report of instruments and accessories used by contestants are believed to be correct. Any error in recording the instruments and accessories shown will be corrected and published upon proof that error has been made.
A. H. FETTERS, Chairman Technical Committee. IRA A. RADER, Chairman Contest Committee.

The AIRCRAFT TRADE REVIEW

A. S. M. E. Annual Meeting

At the Aeronautic Section meeting of the A. S. M. E., on Friday morning, December 9, the following papers will be presented: "Study of the Elastic Properties of Small-Size Wire Cable," R. R. Moore; "Commercial Operation of Aeroplanes," Maj. L. B. Lent; "Problems of Commercial Operation in the Light of European Experience," R. B. C. Noordyn.

Pioneer Aero Company

The Pioneer Aero Company has been formed in Topeka, Kansas, to act as local distributors for the new Longren aeroplanes. The officers of the company are: Dr. F. C. Stewart, Eskridge, president; S. K. Beach, Eskridge, vice-president; Clayton P. Trivett, Eskridge, secretary-treasurer, and E. B. Lopp, Topeka, pilot and sales manager.

Aerial Photographic Maps

The *Engineering News Record* for October 13th contains an illustrated article on the subject of aerial photographic mapping developed for municipal and other engineering services. This article deals with recent developments in aerial mapping cameras and the excellent utility of mosaic maps in commercial use, since they show in considerable detail the objects and localities photographed. Touching on the subject editorially, the *Engineering News Record* comments as follows:

Engineers with a vision cannot fail to see in the development of the aeroplane photographic map a new tool with a wide variety of engineering uses. The mosaic map, however, has been so generally identified with war-time operations that its fields of application in civilian practice is just beginning to receive recognition. Both in the technique of aerial map-making and in the equipment employed therefore substantial progress has been made since the signing of the Armistice. Private enterprise, aided by governmental co-operation, has taken the development of the art where the army left it and carried it forward to a point of commercial practicability.

A number of cities today are using or planning to use aerial photographic maps in connection with such a wide range of engineering studies as city planning, traffic control, water-front improvements, transit facilities, location of new schools, street widening and fire protection. These, of course, are distinctly municipal uses, but in addition such maps offer possibilities in the preliminary investigation of watersheds, hydro-electric developments, highway, railroad or canal location, forest surveys, etc. Comparatively few engineers have sensed the application of the aeroplane map to the solution of many problems upon which they are now engaged. With such innovations as the automatic timing of exposures to cover the proper ground area and at the same time secure the necessary overlap for the accurate fitting together of individual negatives, lenses especially adapted to this type of work, development of the technique covering such details as the best height from which to take pictures for specific purposes, speed of the aeroplane, and the maintenance of a level flight to insure vertically in the view, the maps now being produced attain a high degree of accuracy and a wealth of valuable detail. Among the points worth considering in connection with aeroplane photography in engineering work are the speed with which such maps may be produced, their ability to cover territory inaccessible on foot, their comparatively low cost, and the impossibility of omitting any feature of the area photographed—the detail, of course, depending upon the altitude and the characteristics of the lens employed. Most of our larger cities are concerned with the problem of handling the ever-increasing volume of street traffic. In this field alone the aeroplane photograph offers extremely interesting possibilities.

The advent of the mosaic map, of course, does not mean that such time-tried tools as the transit and stadia or the plane-table are to be discarded. They have now, and always will have, a distinct field of usefulness. Aeroplane mapping, however, has already established itself as a practical means of securing quickly, cheaply, and accurately information which can be put to a wide variety of uses in engineering practice. Engineers who think of surveys only in terms of the old field tools may soon find themselves out of date.

Pioneer Instrument Company

The Pioneer Instrument Company announce that they have made a reciprocal agreement with R. A. Baden of Paris and his associated company, The Société Aréa, whereby Pioneer becomes the American and Canadian representative of this organization and the Baden Co. undertakes the distribution of Pioneer instruments in France.

Personal Par

Lt. W. J. Hoxworth of the Canadian Royal Air Force is now associated with the Hoxworth Oil & Gas Co. of Dallas, Texas.

Meetings Will Boom Commercial Aviation

To make plain the present possibilities and accomplishments of commercial aviation the Society of Automotive Engineers, numbering 5,000 members, is holding a series of meetings this month in cities throughout the country.

One meeting has been held in St. Louis; another will be held in Indianapolis today and a third on Friday in Worcester. The New York meeting will be on December 15, and Cleveland and Philadelphia will have meetings December 16 and December 22, respectively. Those taking prominent parts in the meetings include J. G. Vincent, who had much to do with the design and production of the Liberty motor; Glenn L. Martin, a pioneer in aviation; Ralph Upson, balloon expert; Assistant Postmaster - General Shaughnessy, in charge of air mail, and representatives of the Army and Navy air services.

Germans Back of Atlantic Air Line

Berne.—Hugo Eckner, manager of the Zeppelin works at Friedrichshafen, who has just returned from a trip to South America, said that negotiations between Spain and Argentina were expected to result in the opening of transatlantic air communications between southern Spain and South America.

He said the Zeppelin works was planning the construction of an airship of 15,000 cubic meters, capable of traveling seventy miles per hour, of carrying thirty or forty passengers, besides mail and small parcels between Spain and South America, and of making the trip in four or five days.

Herr Eckner predicted a complete revolution in commercial relations between Europe and South America by this means. He said a Spanish company was being formed to supply the necessary capital and that the technical organizing work would be done by Germans.

D'Annunzio Hopes to Visit U. S.

Gabriele d'Annunzio, Italy's poet-aviator, who became a figure in international politics as the result of his occupation of Fiume, has given through Major James E. Chaney, Assistant Military Attache at Rome, a message to the aviators of the United States, in which he says:

"While the wings of new Italy are racing over this reconstructed lake for the Cup of the Eagles offered by me, I send across the ocean my greetings and the greetings of all Italian aviators to our glorious American companions who with us are steering the aerial prow towards the promise of the future."

Major Chaney states that he met d'Annunzio September 25 at Lake Garda, on which day were staged the international races for the D'Annunzio Cup. D'Annunzio, since his return from Fiume, has led a secluded life in a villa at Gardone-Riviera, overlookiing Lake Garda.

D'Annunzio was extremely cordial, asked many questions about America, and seemed to have a most cordial feeling toward the United States, stating that he was anxious to go there sometime for some of our big aviation competitions. He is lame and has lost the sight of one eye. This due to an aviation accident during the war.

Lt. Bissel Transferred to Washington

Lt. Clayton S. Bissel, who has been on duty with the Field Officers' School, has received orders transferring him to the office of the Chief of Air Service, Washington, D. C.

THE PARIS AERO SHOW

WE are indebted to our contemporary *Flight* for the following interesting data and sketches of the exhibits at the recent Paris Aero Show. The management of *Flight* made valuable use of the Handley-Page airline in delivering its story and photographs from Paris to London. The material was handed in at the airline office at 10 a. m., Monday, November 14, delivered at 3:15 that afternoon at the publication office, and the issue of the paper with complete data appeared Thursday, November 17. We congratulate *Flight* on its achievement.

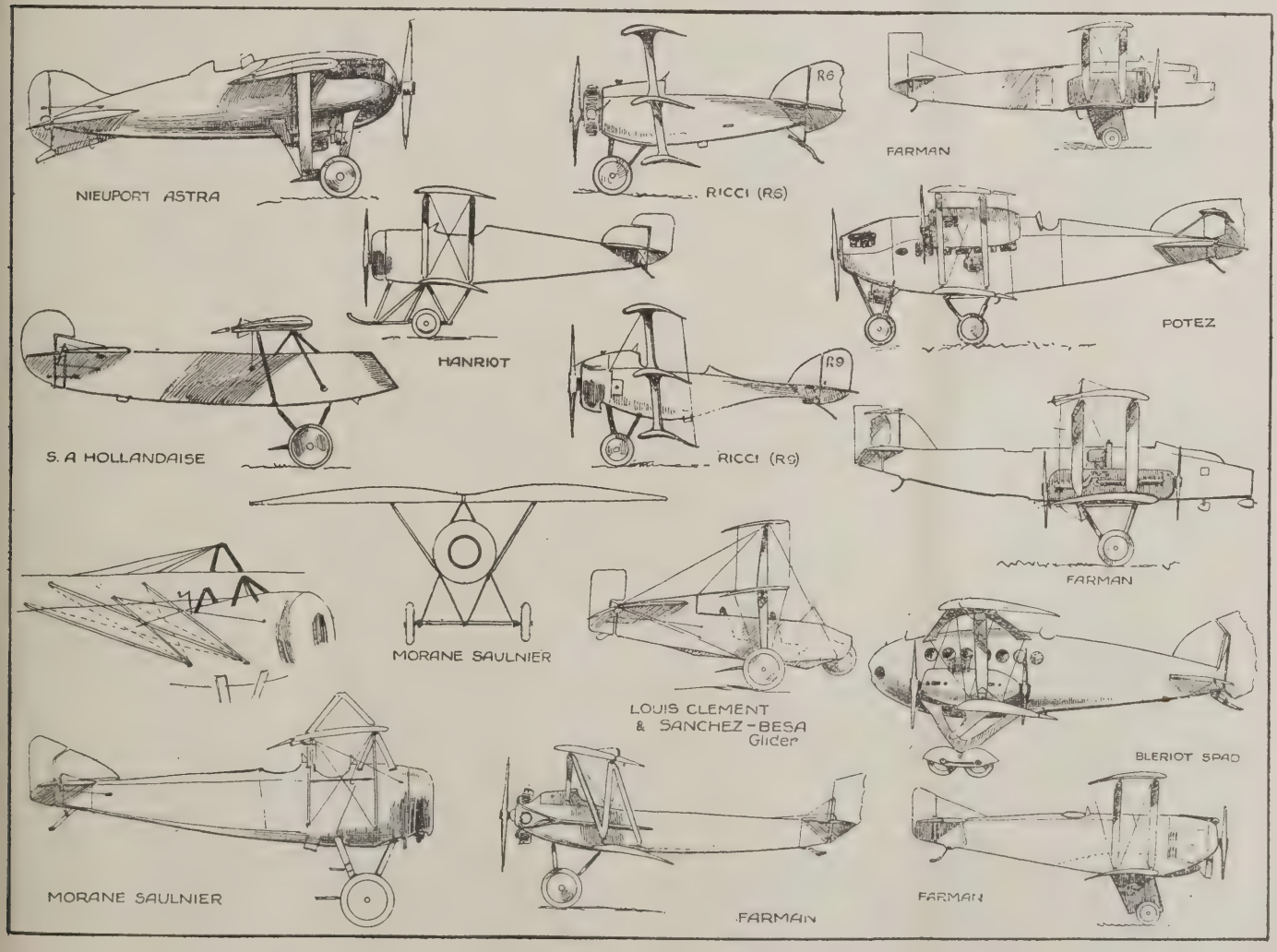
Large machines dominate this year's Salon. Although they are outnumbered by the smaller fry, their wings seem to cast their shadows over the whole of the Grande Nef, and to claim attention by their very size. Towering in some instances with the noses of their *fuselages* over the gazing pigmies walking below, they undoubtedly form the chief attraction as regards the general public. There is a steady stream of people climbing up the steps that lead to the "Pullman" cabins, and the queues remind one of London during the War. From the practical point of view, however, it is extremely doubtful whether these "Mammouths," "Leviathans," and "Juggernauts" deserve the prominence which their size gives them. There is still much to learn in a smaller way before we can profitably turn to these giants, and unless a full load can be guaranteed for each trip (which may be doubtful), they are likely to prove disappointing to run until flying becomes more popular with the general public than is the case at present. Regarded purely as aeroplanes, these large multi-engined machines are, of course, just as interesting as, if not more so than, the smaller ones, and from that point of view they will repay a close study. Also it should be borne in mind that France's policy in the air is vastly more vigorous than ours, and that the next few years will undoubtedly see an enormous increase in the already great extent of France's "airways." Some of these are planned for long distances, where the really large machine may prove more suitable. From the point of view of French constructors, therefore, it may well be that there are better prospects for the large multi-engined machines than one is at first inclined to think. It appears to the writer that we at home have gradually and, perhaps, unconsciously been slipping into the habit of thinking in terms of the London-Paris service, and that as a consequence we may be apt to lose sight of the far greater possibilities which are revealed when one looks farther afield.

From the constructional point of view, one's impression of the Show is that, although not a great deal of progress is evidenced, the general tone of the collection of some 40 machines is better than that of the Salon of 1919. There is a total absence of "freak" machines, and altogether the designs appear less the inspiration of artists and more the result of engineers' work than has previously been the case.

A good many examples of metal work are shown, indicating the increased interest which France is taking in this form of construction, but after a brief examination of these, one feels that the design is not yet on a par with that of England and Germany. It is true that several of the specimens are not new, although exhibited for the first time, and that this may account for them being of a form which was discarded long ago by us. Nevertheless, the fact of this revived interest in France should be a warning to us not to rest content with what we have achieved—even if it is only on a small scade—but to see to it that research work is not allowed to be dropped.

One thing which impresses one is that, although there are still several examples to be seen, the use of piano wire is far less general than has previously been the case, several constructors having abandoned it for streamline wire for the wing bracing. Hitherto, several French constructors have used piano wire for the wing bracing of even very large machines, with the result that the wire was often of very heavy gauge and most unsatisfactory when bent over and locked with a ferrule.

Among the larger machines the use of three engines seems to gain popularity. From the point of view of reliability, this arrangement is quite good, as the stoppage of one engine reduces the power by one-third only instead of by one-half. Also, the turning moment is, generally speaking, smaller for a given power in the three-engined type than in the twin. As



regards the efficiency the advantages are, perhaps, more problematical. The presence of a central tractor increases the drag of the main *fuselage,* owing to the slipstream, and it is said that in the case of one firm which has experimented with three-engined machines it was found that the machine was very little faster when the third engine was fitted than it was in its original form as a twin-engined machine.

If one's recollection serves, no French four-engined machine has ever been exhibited at the Grand Palais until the Blériot "Mammouth" was shown in 1919. This year there are two machines with four engines on the wings, and one with four in the *fuselage* driving a single tractor screw.

Of novelties there appear to be but few, but, generally speaking, the lack of these is more than compensated by the absence of "freaks" and the general improvement in design. As usual, the finish is, with few exceptions, excellent.

The absence of British machines is much to be regretted, the more so as the two examples shown indicate how well British products would have fared by comparison. The Vickers-Vimy Commercial with two Napier "Lion" engines is a very fine machine and well shown. It is sold to the Grands Express Aériens, and exhibited on the Stand of the Atéliers des Mureaux. The Bristol "Jupiter" radial air-cooled engine is a fine specimen of the British aero engine manufacturer's art, and is, with the Bristol Starter, attracting a great deal of attention from "those who know."

With these brief remarks we will leave general subjects and give a brief *résumé* of each of the machines shown.

Atéliers Des Mureaux

Although the banners over this Stand bear an unfamiliar inscription, the machine looks familiar enough, being the Vickers-Vimy Commercial with two Napier "Lions." Generally speaking the machine resembles the older type, except for minor alterations. The cabin is roomy and well lighted, and the comfort of the passengers has been well considered. The machine is to be used by the Grands Express Aériens, presumably on the London-Paris route. It is extremely gratifying to find a French firm using a British machine for their commercial service. In a subsequent issue of *Flight* we propose to give an illustrated detailed description of this machine.

Marcel Besson

This constructor, who has made a specialty of seaplanes, is showing a small single-seater flying boat of very unusual design. Of the type H.6, the machine is a tractor triplane with Clerget engine. The pilot sits aft of the planes, and consequently does not obtain quite such a good view as in a pusher boat. The planes are of very unusual arrangement, the lower having the greatest span and chord. The middle plane is shorter, while the top plane is quite a small affair. There is only a single strut on each side, and these have a pronounced inward slope. There are no flying nor landing wires, the more or less triangulated structure being apparently able to retain its shape without the use of bracing.

Blériot Aéronautique

Three complete machines are exhibited by Louis Blériot, all of the Spad type. By far the most interesting of these is the type 45, a large four-engined machine designed to carry 20 passengers. It is a vast improvement on the "Mammouth" shown in 1919, and bears unmistakable signs of M. André Herbemont's work. In spite of its large size, the machine has only one strut on each side, these being of the type found in nearly all the Spad-Herbemont machines, with cable bracing running to front and rear spars. The engines—400 h.p. Hispanos—are mounted in tandem on the wings. This is undoubtedly an improvement on the spread-out arrangement of the engines of the "Mammouth," and altogether the machine is, thanks to M. Herbemont's genius, a very much more practical proposition than was the older type. The use of only a single strut for a machine having four engines on the wings is somewhat startling, but the manner in which the design is carried out appears to be satisfactory, and in any case M. Herbemont is not likely to be led astray by captivating schemes unless he sees a practical solution for them.

In addition to the large machine, a small two-seater side-by-side school biplane is shown. This is the type Spad 34, with Le Rhone engine. It generally resembles the other Spads in its lines. A Spad "Berline" of the type used on the London-Paris service is also shown, but as this machine is already well known to readers of *Flight,* no reference is necessary beyond stating the fact of its presence.

Louis Breguet

The only new complete machine shown by Breguet is a type 19A^2 all-metal biplane, designed as a fighter, with pilot in front and a gunner aft, equipped with a Scarff gun ring. The machine has only one strut on each side, and these appear to be of sheet duralumin with possibly a channel section stiffener inside. At the ends these struts are forked to meet the two wing spars. Owing, presumably, to the fairly small size of the lower plane, this machine is referred to as a "Sesquiplan." The power unit is a double-row Breguet-Bugatti of 450 h.p., and the machine is credited with a speed of 231 km./hours.

The "Leviathan" all-metal *fuselage,* which has been under construction for probably two years, has duralumin tube *longerons,* with frames of zigzag pressed duralumin bars similar to those of a Zeppelin, but not arranged as crosses. The bracing is by tie-rods. The power unit is a Breguet-Bugatti "Quadrimotem" similar to that shown in 1919. It has automatic clutches so that one or more of the units can cut out without interfering with the others. There is a single tractor screw formed by two two-bladers placed at right angles.

The *fuselage* of a type 14T bis "sanitaire" is also shown, and a five-passenger 14T bis of the old type. A wide seaplane float in duralumin is evidently designed for a large single-float seaplane.

Établissements Caudron

On the Caudron stand the largest machine is a three-engined cabin biplane with Hispano engines. The machine is not unlike that shown in 1919, but looks more refined. For instance, one is glad to note that streamline wing bracing is used instead of piano wire. The central engine is mounted in the nose of the *fuselage,* and the wing engines on the sides of the interplane struts, with supporting tubes running from the bottom plane up to the outer engine bearers. A four-wheeled undercarriage is fitted, and there is a small wheel under the nose of the *fuselage.*

A type C60, similar to that used by Poiree, is also shown, as well as one of the pre-War types with open tail booms. One notices that in the latter machine *ailerons* are fitted. The exhibits are completed by the *fuselage* of a C59 type, which appears to resemble the C60 except for having a Hispano engine.

H. and M. Farman

This is an imposing stand, chiefly owing to the presence of a huge four-engined machine. This is a biplane with 400 h.p. Lorraine-Dietrich engines placed in two pairs in tandem on the wings. The arrangement of the *ailerons* is unusual, the trailing edge of each *aileron* forming a separate hinged unit connected to the rear main spar by rods attached to cranks. The effect appears to be that when an *aileron* is moved down, its trailing edge tilts upwards and vice versa.

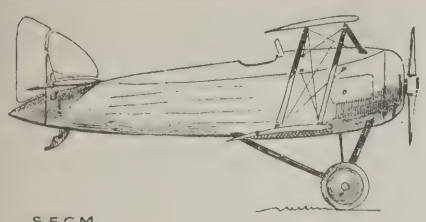
Farmans also show a torpedo-'plane, not unlike the famous "Goliath," but having a deep *fuselage* with open cockpits and a torpedo resting in a large semicircular groove in the floor of the *fuselage.* Apart from these differences, the machine is unlike the "Goliath" in having a single engine in the nose of the *fuselage.* A twin-engined machine with Salmson engines is also shown. This is practically a "Goliath" with minor modifications, notably an open cockpit in the nose of the *fuselage,* apparently intended for the navigator. A small "Farman Sport" completes the exhibits.

F.B.A.

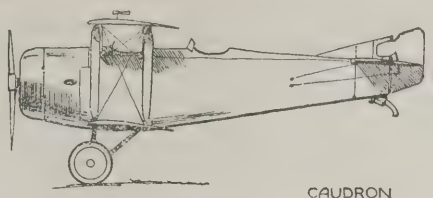
The Franco-British Aviation Co., of which M. "Beaumont," otherwise Lieut. Conneau, of Circuit-of-Britain fame, was a director, is exhibiting a fine piece of workmanship in the form of a fairly large boat hull, fitted with amphibian land gear, the wheels evidently being so arranged as to swing outwards under the bottom plane. A smaller boat hull is also shown, and a pair of wings, one in skeleton.

Avions Hanriot

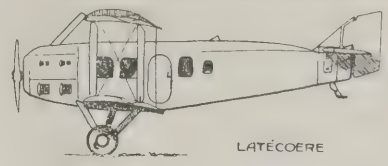
By far the most interesting machine on this stand is the all-metal racing monoplane built for, and which was to have been flown by Rost in the race at Etampes for the Deutsch Cup. This machine is a very fine piece of work and demands a full description, which we hope to publish in next week's issue of *Flight,* if possible with sketches of the detail construction. The *fuselage* is entirely covered with sheet aluminium, as are also the *ailerons.* The wings themselves are fabric-covered in the ordinary way, and might conceivably have given the same trouble as did those of the other machines. Otherwise we must admit that the Hanriot gives the impression of great strength, and it certainly looks capable of extremely high speeds. Everything is well streamlined, and the cantilever wings, although of deep section and consequently probably not of very high L/D., have no external bracing or fitments to offer extra resistance. One had hoped to see the machine shown with the retractable under-carriage but an ordinary one is fitted at the Show. The only other exhibit on the Hanriot stand which calls for reference is a type H.D.14 school machine. This has a rotary engine and a four-wheeled skid under-carriage.



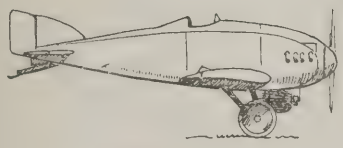
S.E.C.M.



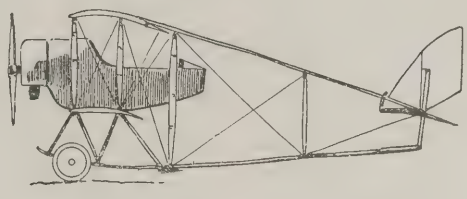
CAUDRON



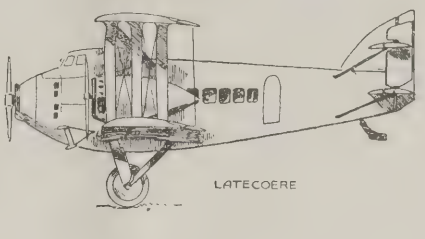
LATÉCOÈRE



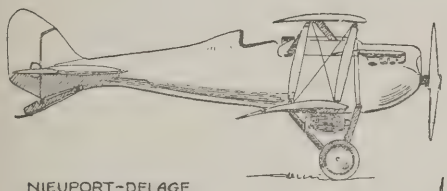
LIORE ET OLIVIER



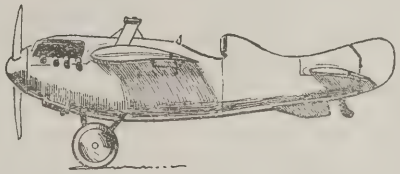
CAUDRON



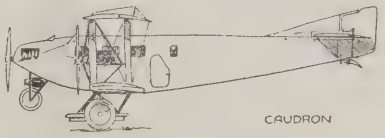
LATECOERE



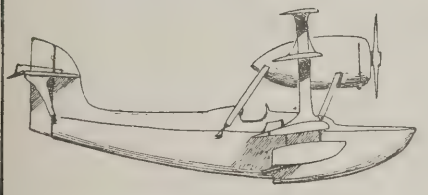
NIEUPORT-DELAGE



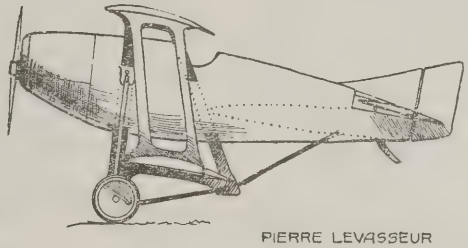
HANRIOT



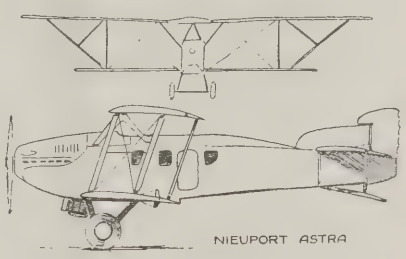
CAUDRON



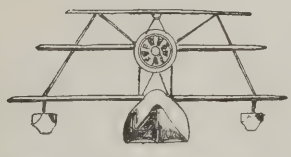
MARCELL BESSON

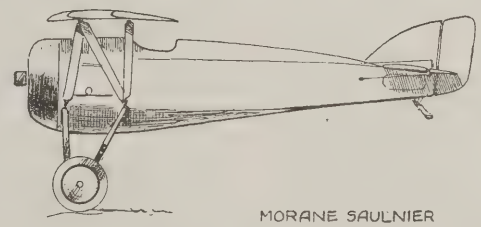


PIERRE LEVASSEUR

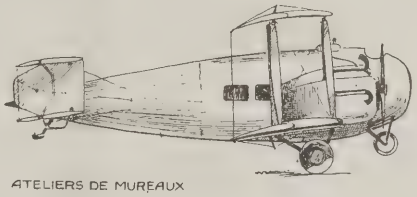


NIEUPORT ASTRA

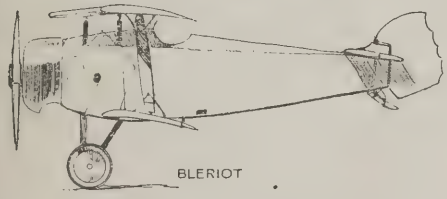




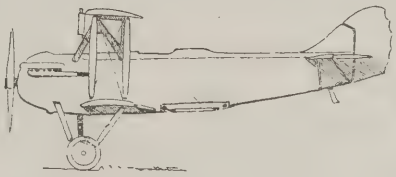
MORANE SAULNIER



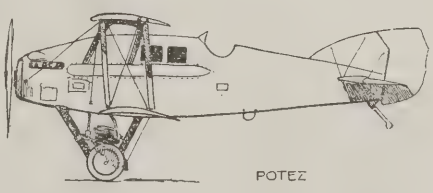
ATELIERS DE MUREAUX



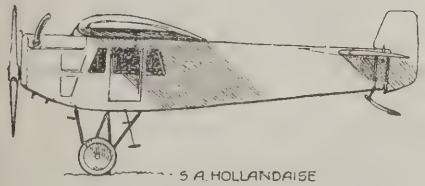
BLERIOT



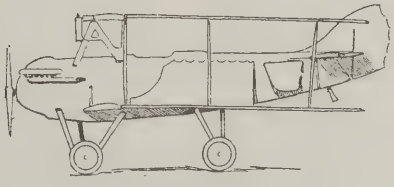
RENE TAMPIER



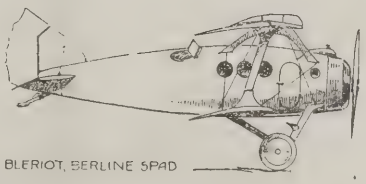
POTEZ



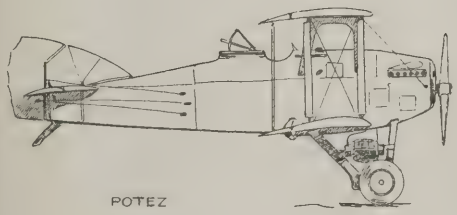
S.A. HOLLANDAISE



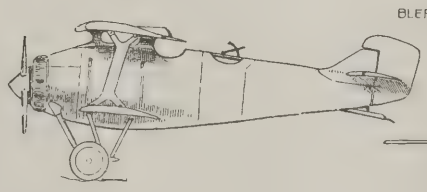
RENE TAMPIER

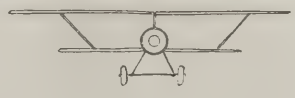


BLERIOT, BERLINE SPAD



POTEZ





LOUIS BREGUET

Pierre Levasseur

Two interesting machines are shown on this stand. One is a torpedo-'plane, very much like the Blackburn "Swift." This machine is shown in skeleton, and gives a good idea of the excellent workmanship of this firm, of which M. Charles Fréchet is a director. M. Fréchet was French Liaison Officer in England during the War, and always makes English visitors welcome on the Levasseur stand. Needless to say, he speaks English fluently. The machine has the whole front portion of its *fuselage* built in steel tubing so as to form a strong separate unit. The engine is a 600 h.p. Renault.

The second machine shown is a side-by-side biplane, suitable for school work. It is of most extraordinary design, with a streamline body. The centre-section struts form a vee, with its apex in the central member of the undercarriage and the other to points on the spars of the top plane. The wings are in one piece, the lower being slipped between the chassis members. The rear portion of the *fuselage* is formed by two multiply members forming a kind of a wedge, the outer covering of the *fuselage* being merely a streamline casing taking no part of the load. The machine should be cheap to make and easy to repair. We shall refer to it in detail later.

A variable pitch propeller is also shown. This, we are informed, has just successfully passed its tests at the *Section Technique*, having completed a 10-hours' run. It was found that the pitch could easily be altered at all speeds up to the full speed of 1,800 r.p.m.

Latécoère

Lignes Aériennes Latécoère are showing two complete machines, and a huge *fuselage* in duralumin. The type Lat. 4 is a cabin machine with three Salmson engines, one in the nose of the *fuselage* and two on the wings. The total power is stated to be 1,000 h.p., so that the Salmsons are rated at 333 h.p. each. The cabin has room for 20 passengers and the total weight is given as being 7,000 kg. (about 15,000 lbs.). The machine is credited with a speed of 180 km. p. hour.

The second complete machine is of the type Lat. 8, with an enclosed cabin, and a single engine. The pilot is placed aft of the cabin. The machine bears the inscription "France-Spain-Morocco."

The large all-metal *fuselage* is for an "Avion de Protection" day-bomber, and must have cost a fortune to build. There are no *longerons* and struts, nor bracing, in the ordinary sense of the word. A number of longitudinal members are triangulated by diagonals running spirally around the streamline *fuselage*. All are of channel section, the diagonals having lightening holes in them.

Loiré et Olivier

This firm, which showed a very original three-engined flying boat in 1919, is represented by a single machine, a type LEO 9 "Avion Monoplace de Chasse." It has a thick high-lift monoplane wing placed at the floor of the *fuselage* à la Junkers. The wing is of uniform chord and thickness, and is of cantilever type. The front portion of the *fuselage* is covered in aluminium and there is a nice spinner over the propeller boss. Except for its cantilever wing the machine does not appear to have any remarkable features.

Morane-Saulnier

Only two machines are shown by M. S. this year, both parasol monoplanes. One is of the school type with wire bracing and is already well known. This was the type which was flown by Fronval with controls locked. It has also to its credit the flight from Paris to Bucharest with 4 landings. The engine is an 80 h.p. Rhone.

The second machine is an experimental monoplane with cantilever wings. These are chiefly remarkable for the fact that they are thin at the root and tips and thick at the point where the centre-section struts are attached. The machine, which is a single-seater, has been flown, but one understands that various minor modifications are still necessary before it is considered ready for series production. It is known as the M. S. type AU.

Nieuport-Astra

Three machines are exhibited, neither of them new. One is a cabin machine, biplane with thick wings and backward stagger, and appears to be the same as that shown in 1919, when it was announced that it was intended for the London-Paris service. An interesting exhibit is the "Sesquiplan," flown by Kirsch in the race for the Coupe Deutsch. This machine is very effectively mounted at a terrific angle of banking, reminding one very much of the late Commander Porte flying the "Thunderbug," at Hendon in the days before the War. The third machine is the type 29 biplane, which, although not new, is still one of the finest single-seaters in the world. Under the gallery is shown the car of an Astra airship.

Henry Potez

Compared with the machines exhibited at the last Paris Salon, the three Potez machines are a great improvement. One is a military two-seater of orthodox design, with a gunner's seat aft of the trailing edge of the wings. The engine is a 400 h.p. Lorraine mounted in the nose of the *fuselage* and driving a tractor screw.

A limousine is also exhibited, with cabin enclosed and the pilot placed aft of the cabin. The front portion of the *fuselage* has a generous curving of aluminium. This machine also has a 400 h.p. Lorraine engine, and is known as the type IX.

The most interesting machine on this stand is, however, the all-metal three-engined passenger machine. The two wing engines are mounted in vees, under which occur the oleo undercarriages. A similar undercarriage is mounted under the nose of the *fuselage*, where is installed the third Hispano. The engines are of 150 h.p. each, and the machine should consequently be very economical to run. With regard to the detail construction we hope to have something to say in a subsequent issue.

Ricci Frères

This Italian firm is showing two diminutive triplanes, one a single-seater and the other a two-seater. At the moment, the span of the two machines is not known, but it only appears to be about 15 ft. Judging from a specimen bottom plane, the wings have but a single spar, and that only measuring about 1½ inches in depth by a thickness of approximately 1 inch. Although this may be sufficient for resisting bending stresses, it appears wholly inadequate for torsion. However, the single-seater type R 6 is said to have been stunted in Italy, and is shown without alteration, just as it looks after having made about 100 flights. The engine of this machine is a 6-cylinder 35-40 h.p. Anzani.

The two-seater type R 9, has a 50-60 h.p. Le Rhone engine, almost totally cowled-in, but appears otherwise very similar to the R 60. Both machines have this characteristic that towards the tail the *fuselage* changes from a rectangular to a triangular section. The consequence is a certain weakness in appearance, which is, however, probably more apparent than real. The machines are obviously the last word in lightness of construction, and should have a fairly good performance.

S.E.C.M.

The machine shown on this stand is a dual control, side-by-side school machine (Letece type XX). Its chief claim to attention appears to be that it is fitted up with navigation lights on the wing struts, and has a searchlight under the lower port wing and a windmill drive generator under the starboard plane.

Soc. An. Hollandaise de Constructions Aéronautiques

Otherwise known as N. V. Nederlandsche Vliegtuigfabriek is an "abreviation" of Fokker. This famous designer is showing an F3 230 Siddeley "Puma" engine. As this machine is already so well known from its work on the London-Amsterdam route no reference to it is necessary, beyond mentioning that an emergency exit has been provided in the roof, through an opening in the wing.

Fokker also shows a neat little cantilever monoplane glider, fitted with an ordinary two-wheeled undercarriage. Although engineless, this machine appears to retain all the Fokker characteristics, and one would know it for a Fokker anywhere.

Rene Tampier

On Friday last, as we approached the Grand Palais, we were treated to the strange sight of an aeroplane with folded wings travelling up and down the Avenue Alexandre III under its own power. That is to say, the propeller was not running, and the Hispano engine also seemed stationary. The machine made a good speed, and appeared to travel backwards as well as forwards. Steering was effected by a pair of wheels mounted approximately half-way between the wings and the tail, and corners were taken in reckless fashion, somewhat in the manner of certain American fire-engines which have rear-wheel steering.

A visit to the Tampier stand reveals the fact that this machine is provided with a small auxiliary engine with transmission to the main aeroplane wheels, which are provided with a differential, motor-car fashion. Some distance aft on the *fuselage* is another pair of wheels, mounted on a folding chassis structure, and so connected up to the rudder controls that they are steered by the same movement. The idea, of course, is that in case of a forced landing one can proceed by road under one's own power to the nearest place where repairs can be effected. The idea is sound, but naturally the extra engine and gear run away with a considerable proportion of the disposable load.



AERODYNAMICAL REPORT AND TESTS ON THE EGGLESTON AIR-CELL GIANT BIPLANE

THE test was carried out on October 12th and 13th, 1921, in the Curtiss 7-foot wind tunnel. The test was conducted by the Cox-Klemin Aircraft Corp., College Point, L. I., N. Y., Consulting, Designing and Constructing Engineers. The test followed standard methods and was carried out on a model of scale 1 to 72 at a wind speed of 30 miles per hour. The stabilizer was set at 3° to the wing chord. The tests included:

1. Lift, drift and pitching moment with the Eggleston Air cells in position.
2. Lift and drift with the Air cells replaced by Standard type streamline struts.

Stability

In the vector diagram, Fig. 1, the results of the pitching moment tests are shown. This vector diagram indicates that with the stabilizer of 3° to the wing chord, a very large degree of stability is secured. The vectors are well separated. Balance at cruising speed is secured if the load is arranged to bring the center of gravity three-tenths of the chord length aft of the landing edge. The position of the vectors is such that if the aeroplane tends to dive down, the aerodynamical forces will return it to its normal flight altitude.

If the aeroplane tends to stall or go up by the nose, the aerodynamical forces will return it to its normal flight altitude. The longitudinal stability of the plane may be therefore regarded as perfectly satisfactory.

Results of Test for Lift and Drag

The results of the test for lift and drag with and without the Air Cells are plotted in Fig. 2.

Those indicate that by replacing struts of standard form disposed in the manner of a Warren truss by the Eggleston Air Cell.

1. The maximum lift is increased from 6.25 to 7.07 pounds on the model, or approximately 13%.
2. The maximum lift/drag ratio of the plane, which is a very fair measure of the efficiency, is increased from 6.66 to 6.86, and the lift/drag at almost all angles is increased.
3. The general efficiency of the plane is high, particularly for a plane having two engine nacelles on either side, and short spans with a larger number of interplane supports.

Landing Speed

a—*With Eggleston Air Cells* (eight in number).

The maximum lift force on the model with the Eggleston Air Cells in position is 7.07 pounds. The landing speed is therefore given by the formula

$$\left(\frac{72x}{30}\right)^2 7.07 = 113{,}000$$

$$x = \frac{30}{72}\sqrt{\frac{113{,}000}{7.07}} = 52.7 \text{ M.P.H.}$$

This is not allowing for scale effect. With scale effect and skillful piloting, it may be expected that the ship should land not much over 45 miles per hour.

b—*Without Egglseton Air Cells.*

The maximum lift on the model without the Eggleston Air Cells is 6.3 pounds, so that the landing speed is 56 miles per hour. From the point of view of carrying a heavy load for a given wing area, the Eggleston Air Cells give a decided advantage.

The designer of the plane, Colonel Thomas L. Eggleston, states that a larger number of cells, namely 12, were originally to be used in this plane. It is not improbable that this would further increase the lift and diminish the landing speed.

Maximum Speed

The following calculations are based on the wind tunnel results corrected for scale affect.

Thrust at 90 M. P. H. $= \frac{6000 \times .78}{90} \times 375 = 19{,}500$ pounds, assuming propeller effieciency of 78%.

Lift-drag ratio of aeroplane at 90 M.P.H. is 5.1 x 1.14, taking the scale correction as 14%.

Drag of aeroplane at 90 M.P.H. $= \frac{113{,}000}{5.1 \times 1.14} = 19{,}400$ pounds, which is a trifle less than the thrust and shows that the full speed will be 90 M.P.H. with full load.

Climb

The best climbing speed is 63 M.P.H.; at this speed the lift drag ratio of the aeroplane (with scale correction of 14%) is 7.84. Therefore, the drag is 14,400, and the expenditure of $\frac{14{,}400 \times 63}{375} = 2420$ H.P. is required to overcome this drag.

The total power available is 3900 H.P., and the difference or excess power of 1480 H.P. which may be used in causing the aeroplane to climb. The rate of climb will be $\frac{1480 \times 33{,}000}{113{,}000} = 430$ ft. per minute. At 6500 feet elevation the rate of climb will be 100 ft. per minute.

Range

The maximum range is attained at an average speed of 65 M.P.H. The power required from the motors is

$$\frac{113{,}000 \times 65}{7.4 \times 375 \times .75} = 3530 \text{ H.P.}$$

The fuel consumption of the motors will be 1800 pounds per hour.

With a fuel load of 28,800 pounds, the range will be

$$\frac{28{,}800}{1800} \times 65 = 1040 \text{ miles.}$$

Useful Load and Pay Load

The preliminary weight estimate—which should be later checked by stress analysis and weight estimates—indicates a total useful load of 47,800 pounds. If a fuel load of 28,800 pounds is carried, a pay load of 19,000 pounds will be left over or the equivalent of 100 passengers with allowance for their baggage.



The Eggleston Air-Cell Giant Biplane

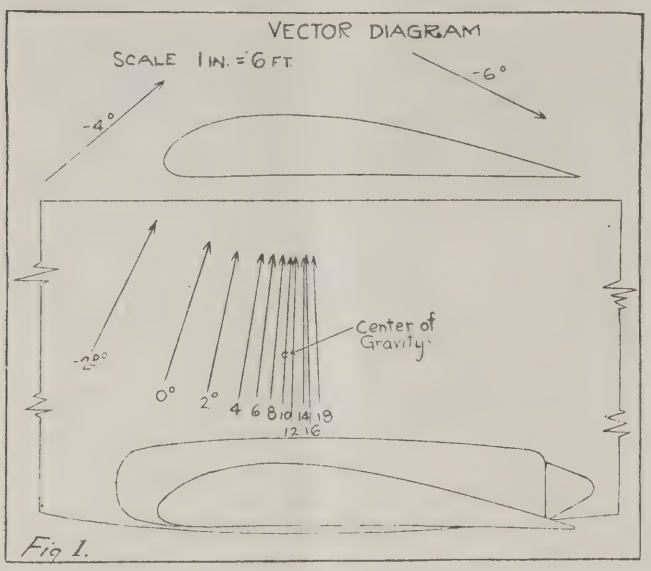


Fig 1.

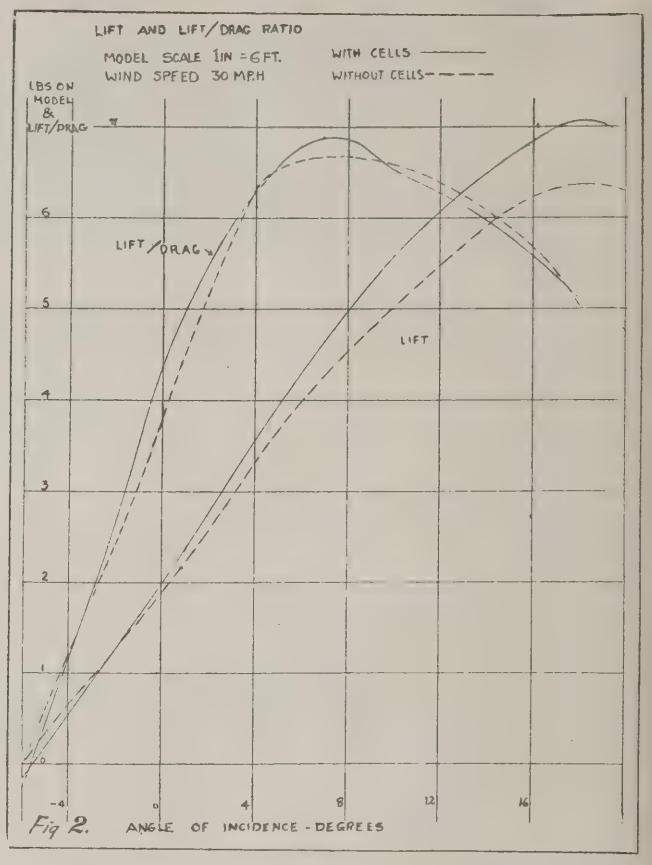


Fig 2.

General Conclusions

The general conclusions to be drawn from the test and general consideration of the plane are:

1—Perfect longitudinal stability is secured.

2—The Eggleston Air Cells improve the lift of a bi-plane.

3—The Eggleston Air Cells improve the efficiency of a bi-plane as compared with a Warren truss strutt bracing of the usual type.

4—With the employment of the Air Cells the number of interplane struts can be increased. This has the effect of decreasing the structural weight, since short spans thus become possible. With ordinary construction short unsupported spans increase the aerodynamic resistance. In the Eggleston Air Cell the extra aerodynamic resistance would be compensated for by the extra lift. There is, therefore, a possibility of keeping down wing weight for large spans.

5—If the structural weight estimated above can be met, the machine should have a maximum speed of 90 M.P.H., a climb of 430 ft. per minute, a landing speed of 45 M.P.H., a useful load of 47,800 pounds, and a cruising range of 1040 miles. The consideration of paragraph 4 would indicate that the structural weight of the wings can be kept down. The stability is good.

6—The fuel load allowed for gives the ship a cruising range of over 1000 miles, which is more than ample for any overland traveling; with a pay load of 19,000 pounds the

(*Concluded on page 326*)

GÖTTINGEN WIND TUNNEL FOR TESTING AIRCRAFT MODELS*

By DR. PRANDTL

(*Concluded from last week*)

In addition to the fact that it can turn on a circular track, a, the device has the further peculiarity that a part of it can float. Fig. 5 shows large pots, g, of which there are four. When water is poured into these pots, the so-called float frame, c, is supported by the floats. By pouring water into the pots, a lift of 0 to 2000 kg. may be generated, so that the heaviest objects can be floated. The purpose of the floats is to enable a horizontal motion in all directions, so that when we attach one or more scales to the object we can measure the forces without trouble from friction.

Fig. 5 shows, for example, an object held by stay wires with its axis vertical, ready to be subjected to the blast. Since it is all mounted on a turntable, any side may be turned toward the air current. Thus far provision has only been made for measurements of drag, but it is intended to provide also for lift measurements.

Fig. 6 is a diagram of the measuring device, the so-called 3-component balance, which has been chiefly used for measuring lift, drag and moment. It has been built on the plan of the very satisfactory device employed in the old plant, with some structural improvements, and also for greater forces. The aerofoils are usually hung bottom up, so that the lift stresses the wires instead of slackening them. In the contrary case, it may happen that the model, when it is not sufficiently weighted, is lifted and the wires are broken. By the above-indicated method, however, nothing can happen. When the model is not heavy enough to withstand a negative lift, a few additional weights are hung on span wires.

The model is suspended by three sets of wires: On the leading edge, by a set of three wires (a, b, c); in the rear by two wires (d, e); and also in front by a horizontal wire (f) against the air current. This suspension is statically determined, which is essential in order that all measurements may proceed smoothly. The static determination of any such weighing device is indispensable for a reliable multicomponent balance and is taken into consideration in the construction of all the balance joints. In the construction of the knife edges a number of new devices have been inevented.

The front system of wires hangs from a bridge, G_1, and the rear system from another bridge, G_2. The points of attachment to the bridges may be varied at will. These bridges hang, in turn, from balance arms, joined in pairs by shafts, to which the bridges are parallel. On the front end the balance arms have extensions (H_1, H_2) to which the rods A_1 and A_2 are attached. The scales for reading are intentionally omitted in the drawing. In reality, they are located about where the letters stand.

The drag wire, f, as in Fig. 4, transfers its force to two other wires, g and h, the latter being attached to the arm of the balance, W (Fig. 6).

It is perhaps unnecessary to state that the axes are not really supported by ordinary bearings, but on carefully constructed knife edges. The bearings are shown in the drawing only for the sake of simplicity and clearness. As in the old plant,

* Translated by the National Advisory Committee for Aeronautics.

the whole balance may be raised or lowered so as to change the attacking angle of the model. This is accomplished by means of the lever at the lower right-hand corner, which may be set at different heights.

Balance, W, gives the drag. Balances, A_1 and A_2, give the lift. Of course, all the balances must first read (or tared and brought to zero) without wind and then read with wind, when the difference in the two readings will give the force of the wind. Models of any desired weight may be used. Most of our models are made of plaster of Paris with a sheet-iron covering.

Fig. 7 shows a model rear view with its suspension wires, as soon from the collector, or blower end. We can recognize the front system of wires (a, b, c) and the rear system (d, e). The drag wire, f, does not show, but the vertical wire, h, does. The bottom wire, k, (Fig. 6) holds the whole system under tension by means of a weight. A small pressure gage is attached at the upper left and extends into the upper part of the tunel. The air current is so uniform that the gage does not need to be moved back and forth.

As shown in Fig. 2, the air is led from the collector to the blower by a cylinder, which was located here to enable the introduction of fresh air from out-doors through the basement through a second cylinder to the blower, in order to perform experiments (with radiators, for example) requiring a constant supply of fresh air. The latter cylinder has not yet been built.

Fig. 8 is a diagrammatic representation of a balance for measuring the six power components, namely, the three forces, lift, drag and drift, and the thre moments about the X, Y, Z, axes. This balance is practically finished. It has not yet been used, because we did not have the leisure during the war to make the final adjustments.

I will only try to give you a general idea of it here. The model is again suspended by six wires, but they are here attached to a rigid triangular board. The forces are resolved not by the model but by this board. The rods which transmit the six components are only indicated here by arrows. Rods 1 and 2 together give the lift and in their difference give the moment about the longitudinal axis. 3 and 4 give drag and the moment about the lateral axis. 5 and 6 give the lateral force and the moment about the vertical axis. With these rods there is connected still another system of levers, whereby the resolution of the forces and moments is effected and the center of the moments is located in the middle of the air current.

This complicated system of levers saves us all calculations and we immediately read on six scales, which in this case work automatically, the results, namely, the three forces and the three moments already calculated for us. Naturally, however, the allowances for the resistance of the wires themselves must be subsequently calculated. This was a difficult task which long delayed the completion of the balance.

Fig. 9 shows the propeller testing device, which has also been constructed from a new point of view. All such devices must give the torque and thrust of the propeller. For the torque, in the ordinary devices, a coupling with a longitudinal motion is required. The couplings heretofore employed generate a moment in the structure which interferes with accurate weighing. They usually have ball bearings. The balls finally wear into the ball race and impair the accuracy of the measurement. The contact surfaces would frequently have to be reground or replaced. Here, instead of the longitudinally moving coupling, the whole mechanism is mounted on the float frame, which is shown at the bottom of the figure. Since the whole mechanism floats horizontally, we can now simply attach the thrust balance to the float frame and thus eliminate the longitudinal coupling. The torque is so measured that a balance indicates the couple at which the float is in neutral equilibrium.

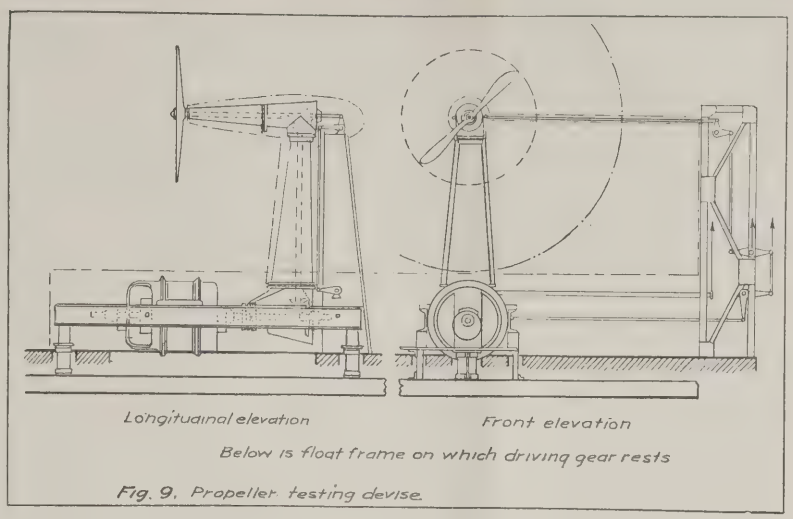


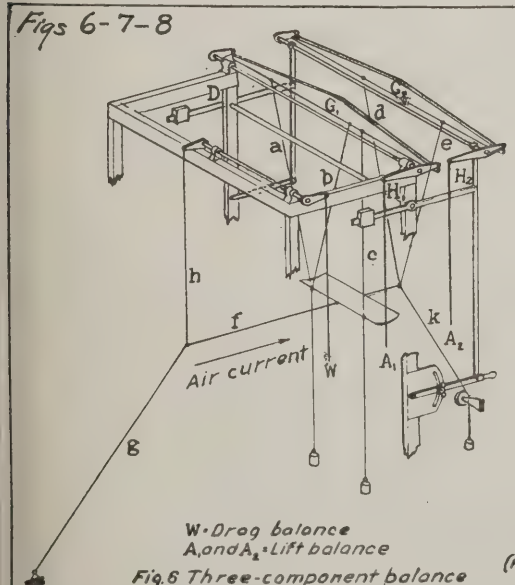
Fig. 9. Propeller testing devise.

The propeller is driven by a 50 h.p. electric motor by means of a bevel gear. All the driving parts are protected from the air current. Otherwise the latter would exert a force on the mechanism which would cause an error in the thrust reading. This propeller testing device has not yet been tried, because the machine works has had to remake the chrome-nickel-steel gear wheels several times on account of some defect in casting or workmanship. The propellers, which will have a diameter of one meter, will probably be driven at a speed as high as 5000 r.p.m. for the purpose of studying the influences of the compressibility of the air.

The new tunnel is designed for an air speed of 54 m/sec. and it will probably be possible to reach 60 m/sec., corresponding to an air efficiency of about 800 h.p. I believe that this plant (so far as indicated by the reports from enemy countries), at least until very recently, was the largest and most powerful of its kind. For the possibility of making it we must thank the generosity of our military administration.

I would not conclude any lecture without emphasizing the fact that I could not have carried the matter through without the devoted and intelligent assistance of my Göttingen fellow-workers. I wish to make special mention of Dr. Betz, who is

Figs 6-7-8



W-Drag balance
A1 and A2-Lift balance
Fig. 6 Three-component balance

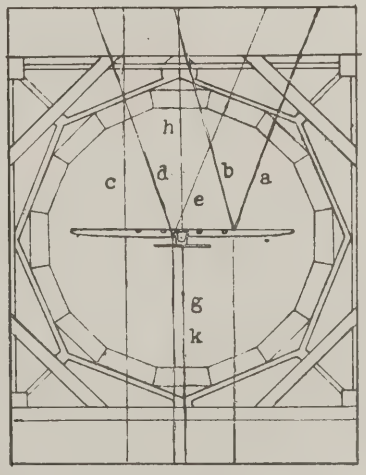
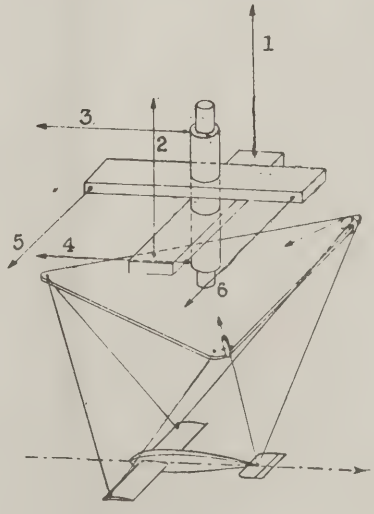


Fig. 7 Method of connecting model (rear view) with three-component balance, looking toward entrance cone.



Rods 1 & 2 give lift and rudder movment
Rods 3 & 4 give drag and elevator movment
Rods 5 & 6 give lateral force and movment
Fig 8 Six component balance.

chiefly responsible for the wind tunnel, which he had previously tested in model form, and which, when set in operation, gave exactly the wind pressure we had calculated. I must also mention Dr. Wieselsberger for the construction of various fine apparatus. Much was worked out in common. For instance, we all helped on the pressure regulator. Dr. Betz also had a large share in constructing the balances. I must also make honorable mention of my constructing engineer from the beginning of my work. Dr. Thoma, who originated the ideas of building the tunnel of reinforced concrete and of giving it the vertical position. This was a great advance over our former method of construction. There are many others whose names I shall not mention, but all of whom I wish to thank.

Remarks

Professor Parseval inquired whether the balance would not lack sensitiveness on account of the four floats. He thought this would result from the great difference in lift, if a float went down on one side while the opposite float went up.

In this connection Dr. Prandtl claims that the center of gravity of the floating portion of the propeller testing device is quite elevated and that, by suitable water filling, the lateral metacenter may be brought as near as desired to the center of gravity. For this purpose the side floats are of comparatively small cross-section in the vertical direction. Hence, the fears of Prof. Parseval can be disregarded.

Engineer Gsell suggested that possibly the Eiffel tunnel might be more favorable in its power consumption than the Göttingen tunnel and that the loss of power at the exit of the former might be smaller than in the return current of the Göttingen tunnel; also that, in the Göttingen arrangement, power might be further conserved by gradually increasing the cross-section behind the experiment place into a "diffuser" before the beginning of the return current.

Prof. Prandtl answered that in fact the Eiffel tunnel appears to be from 5 to 10% more economical than the Göttingen tunnel. The cross-section of the Göttingen tunnel continually increases from the experiment place through the blower and return cylinder as far as the entrance cone. There is a loss of about 15% of the air pressure at each turn. There are, however, other more important grounds for this arrangement than that of a small improvement in economy. The main losses in the return tunnel come from its relatively small cross-section (about 10 sq. m.) at the first two bends, a compromise with the building cost, which would be correspondingly increased by lengthening the tunnel. Eiffel required no turns and saved some power thereby, but he has the disadvantage that his air current returns in all sorts of irregular ways through the hall to the intake place and thereby brings with it all sorts of eddies and cross currents. The fact that Eiffel, in addition to the honeycomb shown in his book, subsequently added another in the entrance cone, leads one to the conclusion that he previously found his air current too uneven. By the closed air current circuit we have the advantage of a very uniform current at the testing place, aside from the convenience of the open space for manipulating the apparatus by means of tracks and cranes, etc.

Professor Junkers stated that, in connection with the theoretically correct widening of the tunnel behind the entrance cone, he had experienced the difficulty that the aerofoil deflected the air stream so that it did not completely fill the widened tunnel, which impaired the effect of the widening. He considered the Göttingen arrangement better than the Eiffel.

Professor Karman agreed with the latter view and added that, if one had an empty airship hangar at his disposal, he might obtain good results even with the Eiffel arrangement.

Professor Prandtl, in his closing remarks, emphasized the fact that, with reference to the cost of building, which plays quite an important rôle, the maximum economy had been forgone. If he were to build again, he would stick to the same system, though improvements might be made in some of the details.

(*Continued from page 324*)

machine should be a most practical aeroplane of undoubted possibilities in commercial transportation.

Eggleston Model Test with Cells

Curtiss 7 ft. Tunnel
October 12th, 1921

i	D_{30}	D_0	D_{s30}	D_{50}	L_{30}	L_0
—6	1.268	.448	.646	.384	.341	.490
—4	1.185	.441	.636	.380	1.031	.490
—3	1.158	.439	.633	.337	1.34	.485
—2	1.143	.437	.633	.376	1.70	.485
—1	1.135	.434	.633	.375	2.042	.480
0	1.138	.431	.633	.373	2.43	.480
1	1.159	.429	.635	.370	2.72	.480
2	1.178	.425	.635	.367	3.16	.480
3	1.206	.422	.630	.362	3.52	.480
4	1.240	.419	.630	.358	3.90	.475
6	1.295	.414	.625	.354	4.61	.470
8	1.375	.408	.610	.350	5.33	.470
10	1.488	.401	.605	.340	5.81	.470
12	1.593	.393	.595	.330	6.35	.480
14	1.700	.387	.590	.324	6.65	.480
16	1.837	.380	.585	.317	7.10	.470
18	1.979	.373	.580	.310	7.30	.470
20	——	.367	.575	.304	7.10	.470

i	M_{30}	M_0	M_{s30}	M_{50}
—6	—1.60	—.32	1.26	—0.32
—4	—1.45		1.20	
—2	—1.33		1.20	
0	—1.21	—.32	1.32	—0.32
2	—1.04		1.30	
4	—0.60		1.30	
6	—0.33		1.35	
8	0.22		1.50	
10	0.69		1.52	
12	1.09		1.52	
14	1.72		1.53	
16	2.12	—.32	1.55	—0.32
18	2.80		1.56	

i	D_{30}	D_0	L_{30}	L_0
—6	1.286	.450	0.49	.50
—4	1.218	.445	1.15	.51
—2	1.190	.440	1.69	.50
0	1.177	.435	2.32	.50
2	1.180	.430	2.98	.49
4	1.205	.423	3.71	.49
8	1.325	.410	4.85	.48
12	1.490	.396	5.77	.48
16	1.706	.382	6.48	.47
18	1.855	.375	6.60	.47
20	2.080	.369	6.55	.47

Main Dimensions and Characteristics

Span of upper wing.....255 ft.
Span of lower wing.....223 ft.
Chord of both wings..... 25 ft.
Gap ..... 25 ft.
Length over all.....137 ft.
Total wing area.....11,200 sq. ft.
Gross weight—loaded.....113,000 lbs.
Total power (8—750 H.P. "W" motors).....6000 H.P.
Wing loading .....10.1 lbs. per sq. ft.
Power loading .....18.8 lbs. per H.P.

First Rough Weight Estimate

Structural weight—37.4% ..... 42,200 lbs.
113,000 lbs.
Power plant ..... 23,000 lbs.
Useful load ..... 47,800 lbs.

Wallace Kellett Co., Inc.

In order to facilitate operations in this country, W. Wallace Kellett, American representative for H. & M. Farman, has incorporated with the firm name of Wallace Kellett Co., Inc.

The company continues to represent the Farman Airplanes in the United States, and there will be no change in the Farman policy.

Offices remain as previously in the Widener Building, Philadelphia, Pa.

NAVAL and MILITARY AERONAUTICS

Airship Mooring Masts of the U. S. Air Service

After war operations ceased, the first system for anchoring non-rigid airships in the open air which proved at all practicable was developed in England. This system demonstrated the safe riding of the airship at anchor in reasonably high winds.

There has been developed by the U. S. Army Air Service a type of mooring mast which has proven very successful for the mooring of airships. The mast, as at present developed, consists of a structural steel tower held in a vertical position by steel cables. At the top of this mast is pivoted a cone shaped padded buffer, which is designed to fit the nose of the airship and distribute the pressure of such airship uniformly over the surface thereof. At the base of the tower or mast there is located a winch mechanism, operated by hand, designed to reel in a cable which is passed up the center of the mast over sheave wheels at the top and fastened, when the mast is in use, directly to the nose of the airship, which is suitably reinforced to withstand the strain. The mast has been designed with particular reference to portability, being made up in four sections, each 18 feet in length, making the total height of the mast 72 feet. An erecting derrick is provided, integral with the base of the mast, by means of which the mast may be installed in a minimum length of time. The entire mast may be disassembled into its 18-foot lengths, placed aboard standard Army trucks, and transported to its new site and there reassembled and erected in a minimum length of time, and with only such equipment as is contained in the mast itself, excepting a few small tools and old pieces of timber, etc., which would be required as dead-men for the securing of the guy cable.

Experiments with the mast conducted at Langley Field have been very successful and, while slight alterations are being made—as is always the case with entirely new designs—the basic idea and general dimensions of the mast, as they were originally designed and as they exist at present, will not be changed to any appreciable extent in future designs for this size of mast. This mast will properly handle ships from the smallest size, i.e., 35,000 cubic feet capacity, to ships as large as the Roma, which has a capacity of 1,200,000 cubic feet.

Arrangements are being made for the installation of auxiliary devices, such as direct piping, through the mast to the ship, of water, fuel, buoyant gas, compressed air, etc., and doubtless in the future development of this mast these auxiliary devices will receive more and more attention and the mast thereby refined considerably. Masts such as this, located at various points throughout the country, at municipal landing fields, Air Service flying fields, and the various strategic and protected sites, will provide means whereby airships, even to the smallest size, will be able to fly with entire security, traversing the entire country, and thereby establishing new means of rapid transportation.

The operation connected with the landing of an airship and attaching it to the mooring mast is a relatively simple matter, although great caution and skill on the part of the airship pilot are required to insure the security of the craft against damage. Upon approaching the mast, at an elevation of between one and two hundred feet, the mooring line is dropped and the end of it fastened to the end of the mooring mast cable which, as above mentioned, passes up through the center of the pivoted buffer cone over sheave wheels and down the center of the mast onto a storage drum actuated by a hand winch mechanism. The winch is now operated, drawing the ship's nose securely up into the padded cone, and the ship is secure and safe from any damage from ordinary weather conditions, flying from this position exactly as a weather vane does. As soon as the ship is secure, the hydrogen, fuel, air and water lines are connected to the ship, and she is prepared to either take off again on a continuation of her flight or to remain for weeks or months, requiring a minimum of attention upon the part of her crew. To perform the operation above outlined requires the services of but from five to twenty-five men, depending upon the nature of the air currents in the vicinity of the mast.

Upon approaching a mast preparatory to making a landing, an airship "weighs-off," i. e., the pilot discharges ballast or gas, depending upon whether the ship is "heavy" or "light," until the airship is in static equilibrium, or preferably a little "light," or, in other words, has a tendency to ascend upon the motors being idled and the dynamic effect of the controls neutralized. The ship is then directed toward the mast, approaching nose into the wind. Immediately the mooring cable is attached to the mast winch cable, the propellers are reversed, and a constant tension maintained upon the mooring cable until the ship is secure in the mast. In the absence of reversible propellers a few men are distributed upon the tail, handling guys to steady the ship into the wind and to prevent its yawing and riding up into the mast at too rapid a rate or by surges. While the airship is attached to the mast a single attendant, to maintain constant pressures in the gas compartments and the static equilibrium of the ship, is sufficient.

Test Flying at Night

On November 10th, 1st Lieutenant Alexander Pearson, Jr., 12th Squadron (Observation) stationed at Fort Bliss, Texas, took off at 9:30 P. M. for a night test flight. He flew a DH-4B plane, especially prepared for cross-country trips, having extra gas and oil tanks. Lieutenant Pearson was in the air 45 minutes, and without lights made a perfect landing on the aerodrome. He has on previous occasions made cross-country trips at night, finding his way over mountains and prairies and landing on the Fort Bliss aerodrome without trouble. On one occasion he and Sergeant Jungling were in Prescott, Arizona, doing work in the Grand Canyon, when late one afternoon orders were received to return to Nogales, Arizona, at once. The plane was made ready, and the trip was started at 7:30 P. M., 255 miles being covered in three hours' flying time and the landing at the aerodrome in Nogales being made at 10:30 P. M. The field at that station is a two-way field and very small. The landing was made without lights.

Anti-Air-Craft Target Practice Near San Pedro

Navy officers at San Pedro are attaching much significance to the arrival of Capt. H. V. Butler, commander of air squadrons, Pacific, and his senior aide, Lieut. Comdr. P. N. L. Bellinger, in command of a squadron of six F-5-L seaplanes. The tender *Aroostook* accompanied the planes on their trip from San Diego.

Fleet gunnery officers and the air squadron commanders are working on plans for joint practice of the battleship gunners and the planes, to be held next month. The plans include the towing by the planes of kite targets above the battleships at sea. Anti-aircraft gunners will attempt to hit the targets as they are being towed overhead at a speed of 60 miles an hour, it is said. This, however, is only one of the features of the plans now being worked out. Aerial photography, a branch of work which the Navy has been developing rapidly within the past few months, will play an important part in the maneuvers.

The program, officers say, is one of the most important ever worked out by the Navy in peace times, and emphasizes the new importance attached by naval authorities to the efficacy of planes in warfare.

Navy officers say that if the experiments prove successful it is probable that all future anti-aircraft gunnery practice aboard the ships on both the Atlantic and Pacific will be carried out with the aid of planes and towing targets.

Fort Sill Accident

Lawton, Okla.—Four army aviators, two officers and two privates were killed November 30.

The two aeroplanes in which they were performing combat duty drills collided while at an altitude of 2,000 feet, and crashed to earth near Fort Sill field.

The dead are Capt. Loomis, Lieut. A. T. Lanfall, Private Tubbard and Private B. A. Smith.

As the aeroplanes struck the earth, their gasoline tanks exploded, enveloping the wreckage in flames. Trucks and ambulances were rushed to the scene, but attendants were unable to reach the bodies of the men until they had been charred beyond recognition.

Army Forest Patrol

Army aviators fiying in the forest patrol service discovered and reported 600 fires in California. Of the total number of fires discovered, 480 were reported by radio from the planes.

Fifteen radio stations co-operated with the air service in obtaining reports of fires. The airmen operated from March Field, Visalia, Mather Field and Corning. About 30 De Haviland planes were used in the forest patrol service.

FOREIGN NEWS

Portugal Loses Air Fleet

Lisbon.—The greater portion of the Portuguese air fleet was destroyed November 28 during a heavy windstorm which broke over the military aviation camp near here. Among the planes destroyed was one built for attempting a flight from Lisbon to Portuguese Guinea in Equatorial West Africa.

British Air Ministry

All sorts of rumors appear to be rife as to the future of the Air Ministry. It has been said that the Geddes Economy Committee is to recommend the abolition of the Ministry as a separate Department of State, but it has explained that, in common wtih all other Deparments, the Air Ministry was asked to answer a number of questions relating to details of its work and the expenditure involved, and also to justify both policy and the costs involved in carrying out that policy. It is stated by one morning London newspaper that "As far as can be ascertained" there is no definite suggestion at all on the lines that the Admiralty and the War Office shall again take charge of their own flying services. To emphasize this, the Prime Minister stated recently that the Government had not decided to do away with the Air Ministry as a separate Department. It may be observed that he did not say the Government had taken a definite decision *not* to scrap the Ministry.

As we are not in the inner councils of the Government, we cannot profess to know what is in their minds, but this we do know: that the constantly recurring rumors of the kind under discussion are doing no good at all either to the Royal Air Force or to the civil side of the Air Ministry's work. To enter upon a long discussion of the matter in its present stage would be quite unprofitable, so we shall leave it for the time being with the remark that the sooner the Government again announces in the most unambiguous terms that the Air Ministry is now as much a part of the machinery of the State as, let us say, the Home Office, and that it is here to stay, the better it be for all concerned.—[*Flight.*]

Kinshasa-Stanleyville (Belgian Congo) Air Mail Service

The British Postmaster-General announces that the Administration of the Belgian Congo has made arrangements whereby correspondence from this country for the Upper Congo may be forwarded by the aeroplane service which is now working between Kinshasa and Stanleyville (and intermediate points) in close connection with the arrival and departure of the Belgian packets from and for Europe.

The transit from Kinshasa to Stanleyville is due to be accomplished by air in three days, as against 14 days by river steamer; and correspondence for all districts along the Upper Congo River from Kwamouth as far as Lowa (but not for districts such as Katanga) should save up to a maximum of 11 days in time of transmission by the use of the air service.

Letter packets of all classes, registered and unregistered, but not parcels or insured packets, are admissible.

Any packet intended for onward transmission by the air service should bear the "Air Mail" label in the top left-hand corner, and be plainly marked by the sender immediately beneath it, "Par avion *viâ* Kinshasa." The packet should not be specially prepaid, but a fee of 3 francs per 20 grammes for air conveyance will be charged to the addressee on delivery.

Packets posted in time for transmission to the Congo by other than a Belgian steamship will probably not benefit by the use of the air service, and should not be marked for transmission by it.

"Nordstern" Becomes "Mediterranée"

By decree the name of the surrendered German dirigible "Nordstern" has been appropriately changed by the French to "Mediterranée," having regard to its employment next year on the commercial air service between Marseilles and Algiers.

Aerial Surveying in Australia

It is reported that an aerial survey of approximately 3,000 miles of country in Central Australia has been completed by Mr. Francis Birtles, who reached Melbourne on October 26.

Nungesser's Flying School

The famous French "Ace" Nungesser is reported to have opened a flying school at Orly. The school receives a State subsidy, and numerous pupils are said to have already enrolled. On a recent visit to the establishment M. Laurent Eynac, the French Under-Secretary of State for Air, is said to have expressed satisfaction at the manner in which the school is being run.

Canadian Air Mail Service

Sydney, Nova Scotia, November 24—The Newfoundland government aeroplane which will inaugurate a St. John's-Halifax mail service next week, is to make North Sydney a port of call for oil and petrol, according to instructions received by local officials of the Reid-Newfoundland Company. The machine was formerly used to scout for seals off the Newfoundland coast.

Aviation Meet on Lake Garda, Italy

The International Aviation Meet for the Gabriele d'Annunzio Cup took place on Lake Garda, September 16 to 25, 1921. Cash prizes to the amount of Lire 100,000 were awarded in addition to the d'Annunzio Cup and cups offered by the Ministry of Industry and Commerce.

The race for speed aeroplanes took place on September 18th over a total distance of 200 km. The course was very irregular, taking in various points around the lake, and was made four times, each lap being fifty km. Three Italian Navy Pursuit Seaplanes, M-7 type, entered, all of them completing the total distance. The three competitors started simultaneously, and this race was a very exciting one. Lieut. Conti of the Navy won first place in an M-7 pursuit seaplane, equipped with Isotta-Fraschini V-6, 250 h.p. motor; time 1 hour, 2′ 43″, average speed 191.336 km. per hour. This pilot won by making a daring turn at the last buoy, as he and Merola were practically tied during the entire race. Lieuts. Merola and Vuan of the Navy won second and third places respectively, the former's time being 1 hr, 2′ 43 3/5″, average speed 191.296 km., and the latter's time 1 hr, 5′ 29″, average speed 183.252 km. per hour. Merola made the fastest lap of the race, covering the 50 km. at an average speed of 195.355 km. per hour.

The race for seaplanes carrying a commercial load of 200 kg. took place on September 20th over a total distance of 200 km. This was over a different circuit from the race on September 18th. Each lap was 100 km. Five seaplanes entered this race and four completed the total distance, an M-9 being forced to withdraw after 150 km. Conforti of the Navy in an S-13 (I.F., V-6, 250 h.p.) seaplane, won first place, time 1 hour, 2′ 33 3/5″, average speed 191.815 km. per hour; Falaschi of the Navy in an S-13 seaplane was second, time 1 hour, 4′ 29 4/5″, average speed 186.095 km. per hour, and Passaleva of the Navy was third in an M-9 (Fiat A-12 bis, 280 h.p.), time 1 hour, 4′ 35 3/5″, average speed 185.777 km. per hour.

The final race for the cups was a handicap affair over a distance of 180 km. (5 laps of 36 km. each). Merola of the Navy, in an M-7, who was the last to start, as he was handicapped by 9 minutes 19 seconds, was the first to arrive, winning in 54′ 59 2/5″. Six competitors entered this race and all completed the required distance.

On other days of the Meet contests were held in acrobacy and for speed over a nautical mile course. A total of 15 different seaplanes competed in the various races. No new types, especially constructed for the races, were presented.

Two gliders (fast sea-sleds) with air screws, equipped with I.F. V-6, 250 h.p. engines, took part in special races held for them. The maximum speed developed by the faster of the two was about 85 km. per hour. Gliders of this type were used on Lake Garda during the war by the Italians for messenger service. The hostile lines crossed Lake Garda. According to a statement of the Chief of the Italian Naval Air Service, the Navy since the Armistice had carried out some experiments with gliders with the view to using them in off-shore defense, equipping them with machine guns, cannon, and possibly with torpedoes and large bombs. When equipped with large bombs, the pilot would jump with a life buoy before impact. All types that had been constructed in Italy were found absolutely unsatisfactory in the open sea on account of being too short to take the waves. For lack of available funds no new types along larger lines were built, and the experiments were discontinued. Two of the gliders were put into service by the Italian Navy along the Dalmatian Coast during the operations against d'Annunzio's forces, one of which was lost with the Naval Lieutenant-in-Charge. Their service was unsatisfactory.

Italian Aviation

A regular aerial service has been established by the Colonial Government of Lybia between the cities of Tripoli and Homs. The aeroplanes used belong to the Army and are part of the aerial force stationed in th Colony. Aeroplanes of the Caproni 450 type are used for transporting passengers and the S.V.A.10 type are used for transporting mail. The distance between these two cities is only 100 kilometers.

The safety of commercial aviation in Italy is illustrated by the official report of the activities of the civil aerial transportation company (Societa Anonima Imprese Aeree) covering the first year of its operation from June 1, 1920, to June 1, 1921. A total of 996.11 hours were flown over a distance of approximately 100,000 kilometers, 3,351 passengers being carried without accident. This line did not operate during the months of December and January. The greatest numbr of passengers (591) were carrid in July, 1920, followed by September with 520, and the lowest number carried during any month (138) was in March, 1921. Passenger traffic was heaviest during the summer months.

French Aeronautics

For some time it has been the intention of the Franco-Roumanian Aviation Co., who operate the Paris-Strasburg-Prague-Warsaw air line, to extend their line to Bucharest. On October 22 the first direct flight was made, and occupied 14 hours, including the stops at Strasburg, Prague and Budapest. By train the journey occupies about 63 hours, so that the saving effected is very considerable.

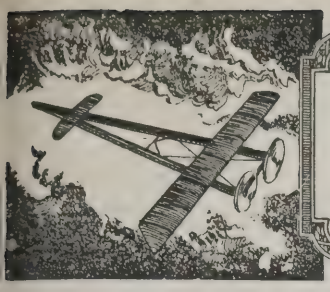
To replace the temporary resting places of the historical collection of objects relating to air navigation which have hitherto been deemed adequate in France for the purpose, a new "museum" is to be formally inaugurated on November 22nd at Chalais Meudon. "La France" hangar is to be utilized to this end, and the public will then have an opportunity of conveniently studying the many interesting "relics," etc., which have been collected relating to the past history of aviation.

Encouraged by the success attained during the German gliding competition in the Rhon hills this year, France has resolved to hold, next year, a somewhat similar competition. At present it is proposed to hold the competition from July 6 to 20, 1922. The competition is to be organized by the French Aerial Association, but before settling the rules and regulations it is proposed to call a "Congress" at the Grand Palais to discuss the possibilities of such a competition. The Congress is to take place on November 26 and 27 in one of the lecture halls of the Grand Palais, and the only condition imposed for admission to this Congress is that a communication should be made to the Congres d'Aviation sans Moteur, addressed to the General Secretary, M. Georges Houard, 17 Boulevard des Batignolles, Paris. The communications should bear on the following subjects: Theory or application of gliding flight; method of making the experiments; information relating to the Rhon experiments; rules and regulations of the French Competition in 1922, or suggestions concerning the competition, such as suitable place for holding it, rules and regulations, etc. Communications should not exceed 1,200 words and those accepted will be published in the French publication *Les Ailes.*

France is gradually turning the port of Antibes into an important air station, and it is hoped to establish air lines running to Corsica, Sardinia and Tunis, using Antibes as the French terminus. On October 18th a seaplane flew from Antibes to Corsica (Ajaccio) in 3 hours and 10 minutes, which is a very great saving of time as compared with the time taken by steamers.

Holland and Air Defence

In the 12-year scheme of naval defence for the Netherlands and Dutch East Indies, the Dutch Government has laid before Parliament aircraft figures in no mean degree. For the Indies, besides the various cruisers, destroyers, etc., provision is made for 72 reconnaissance 'planes, 18 bombers and 18 battle 'planes. For the Home Naval Air Force 35 reconnaissance and 15 battle 'planes are provided for.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Some Notes Regarding Soaring Birds

(Continued from last week's issue)

IT is evident, however, that in order to gain height, it is necessary for the bird to resort to circling, and so far as the maneuver can be followed, its phases appear to be as follows:

The bird is assumed to be facing the wind; he lowers one wing (say the left) and turns to that side, the wind catching him under both wings, blowing him along with increased velocity. He continues to circle and is now gliding away from the wind, his velocity (relative to earth) now reaching a maximum. Continuing the circle, he is now moving across the wind, to which his back is presented, the outer wing being raised. During these three phases it appears that remarkably little, if any, height has been lost.

In the final phase of the circle, he faces the wind, bringing his wings into a horizontal position and increasing his angle of incidence so as to get as much lift as possible, even at the expense of drag, which is now obviously in action, the reduction of velocity with reference to the earth, being as apparent as the gain in height, and the bird only turning again when his forward velocity with reference to the earth has been almost expended in the production of lift.

The cheel is not the only bird possessing such powers—the vulture, saras, eagle, hawk and other birds also have them in a marked degree, but the cheel is very common (in India, where the observations were made by Capt. Wildeblood) and is a most efficient soarer. In the evening, after the wind drops, cheels flap heavily and alternately glide from point to point with a perceptible though small gliding angle.

Some Observations of Bird Performances

A cheel soaring very high, facing the wind, had the front edge of the outer primary feather inclined backwards at about 45 degrees. On the other hand, a vulture soaring at a lower level had his wing fully extended and the front edge of the outer primary feather almost in line with the front edge of the wing, which is at right angles to the line of flight.

A vulture, soaring overhead, moved his wing tip apparently with the object of depressing and retarding that wing. The movement is very noticeable in these large birds.

In the morning, when the breeze begins to rise, the cheels get up and flap and glide heavily until clear of the tree tops, when they circle and soar with an occasional flap or two. The cheels that come down for breakfast always have to flap to ascend.

Soaring in a very light breeze, a cheel which started at the level of the house tops, had risen at least two hundred feet without losing any headway against what slight breeze there was, and indeed making a little headway of perhaps fifty feet against it. Other cheels were soaring higher up at about 1,000 feet.

Behavior of Birds in a Windstorm

Some birds were observed flying in a windstorm while the gale was at its height. First was noticed a cheel soaring, head to wind. The wings were laid right back, the wing-tip feathers quite parallel to the body.

Then crows were seen in the same attitude and then pigeons, all soaring and flapping alternately. Even the doves and jays tried to do the same, though cautiously keeping near the ground and looking like beginners learning to skate. The wind velocity was terrific, and when a cheel or crow or pigeon turned and raised a wing to take the force of it, the bird shot away at a marvelous speed, turning again, however, quite easily, at will.

It is the observer's belief that, when in difficulties, the birds do make use of the lateral righting effect of feathers, inclined backwards, and having quills on their outer edges, an arrangement found to have so remarkable an effect in models of aeroplanes. The fact is not overlooked that the reclining backwards of the wing-tips may also be necessary for longitudinal stability or other reasons.

(To be continued)

Model Bodies Built of Papier Maché

A system has been worked out by Mr. Charles H. Lea, 538 Gridley Avenue, Akron, Ohio, for building fuselages of such models as the Verville-Packard of papier maché. A thirty-two-inch model, built from AERIAL AGE plans, but with this new type of body instead of the balsa wood which was suggested (and apparently rather difficult for some model builders to obtain) weighs ten ounces. It is believed that a reduction in the weight can be made in future models having the same type of body.

The papier maché method results in a fuselage strong enough to withstand the twist of the elastic motor, without using a separate motor-stick, and still the tail does not twist out of true.

Mr. Lea built a JN-4D2 model last summer. He is fortunate in having the assistance of a "chief test pilot," Lytle Tumer, who follows Mr. Lea's work with interest. Further inspiration is received from the builder's daughter and her little chum, who delight in the flights these models make. Mr. Lea is now planning to build a model of the Curtiss Navy racer.

The Requirements of Aeroplane Engine Design

The principal features desirable in the design of an aero engine are low weight per horsepower, reliability and smoothness of running, low fuel and oil consumption, compactness, simplicity of construction, ease of overhaul, reasonable initial cost and freedom from liability to fire.

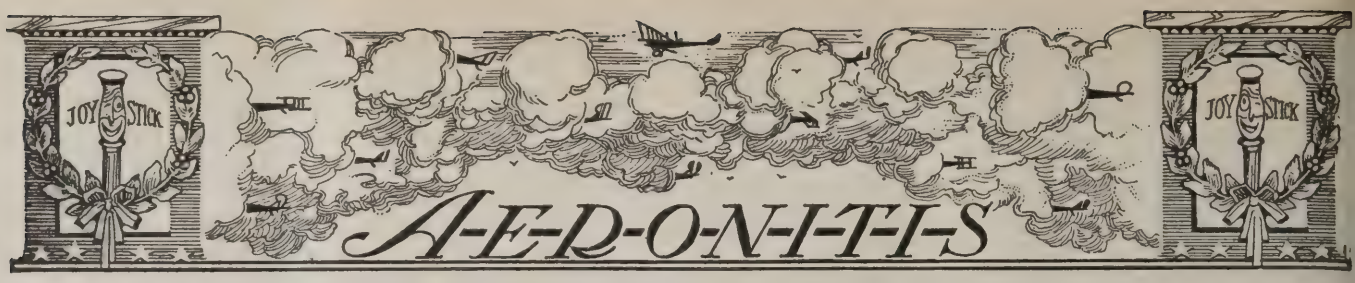
The question of weight does not end with the engine itself. All the accessories must be included. In the case of the water-cooled engine the weight of the radiator and cooling water must be added. Separate special accessories, such as gasoline pressure pumps, carburetor and ignition controls, etc., must be considered. Another important factor in the weight problem is fuel economy. An engine designed to be of minimum weight per horsepower is usually less economical in oil and gasoline. For flights of short duration, the combined weight of engine and fuel would be less with the light engine. For prolonged flights, however, a heavier engine and a more economical one would actually be the lighter combination.

Reliability is a subject on which a great deal might be said. Probably nine-tenths of the accidents which occur are attributable to engine trouble. The commercial value of reliability is therefore obvious.

After the most skillful designer has done his utmost to bring the various parts to a standard of safety, tests only, either on the bench or in the air, can be relied upon to effect further improvements. Questions of wear, for instance, are chiefly matters of test. In any new engine certain parts will be found to wear out unduly in use. The designer must take this matter in hand, substituting more desirable materials for those originally used in these parts, improving their lubrication or increasing their dimensions as may be advisable. Over-loading is certain to occur sooner or late, and when an engine is sufficiently overloaded something inevitably breaks. This reveals the engine's weakest spot and when the latter has been strengthened the next weakest fails upon over-loading. Thus by a process of constant experiment, with its resulting elimination, a chain is obtained in which all the links are more nearly equal in strength. The engine that has no weak point is really an ideal. The practical engine, however, is purposely designed with certain weaker points, the object being to localize to some particular replaceable member any damage which may occur owing to an excessive over-load; this acts in a way as a safety value for the rest of the structure. Although a very great deal depends on the original design, it is only by subsequent lavish experiment that the maximum reliability is reached.

A few of the most important factors which contribute to reliability of running as discussed by G. C. Baily, author of "The Complete Airman," will be given in a subsequent issue.

(To be continued)



A Flying Cadet's Bible

How many of us remember the trials of a Flying Cadet during the war before he was permitted to take the stick for the first time alone? Not the least of his troubles was encountered in ground school, where the habit of having him write the answers to questions on subjects he was supposed to have some knowledge on tap seemed developed to a most uncomfortable degree.

Aside from spelling, of which there were a large number of phonetic cases, the embryo airman sometimes got funny results from his attempts to express what he knew or thought he knew in answer to the questions of his instructors. The cadet who preferred "coatin the wires and cables of a plane with *paraphin* or grease to keep them soft and pliable" must have revised his opinion before completing his first hour in the air. He must also have found that a longeron was something more than "the line of stability drawn from the front to rear of an aeroplane." The ideas of some of his brothers-in-arms, as gathered during the life of the ground schools, were equally brilliant, for, according to them:—

1. "An aileron is a device on an aeroplane which by action of the air on itself when propelled through the air causes it to bear itself in the air."
2. "The aspect ratio is the ratio between two parts as they seem to be and as they are in reality."
3. "A side-slip is falling away from the center of gravity by rotation about the fore and aft axis."
4. "Nose dive—a steep ascent nose down."
5. "Side slip—the manner of landing a plane when it catches on fire."
6. "Steel is tempered because then its structural resistance will be greater."
7. "Droop is the amount of wash-in we put in the left wing of a normal engine to overcome propeller torque."
8. "The heart of a tree is discarded because it is more 'naughty.'"
9. "Skidding is a thrill experienced when an attempt is made to turn in the air without making the proper degree of bank."
10. "In the daily inspection sighting is usually done by eye."
11. "The angle of incidence increases as the lift is changed from zero to 90 degrees."
12. "Disadvantages of soldering—weak but stronger than nothing."
13. "Soldering adds to friction, it is liable to be used for strength which it won't stand."
14. Some new ideas—"inherited stability; angle of indecence."
15. "Wires may be protected from moisture by covering them with something. We have galvanized wires and vanishing wires. The last method is the best."
16. "Galvanizing is preferred as a protection to wires as you use a much higher temperature when galvanizing and that tempers the steel wires."
17. "A factor of safety is a thorough inspection of a plane before flight and the renewal of any worn parts."
18. "Gap (of an aeroplane) is an airhole."
19. "Propeller race—the propeller turns so fast it races and exerts no thrust."
20. Propeller tested as to fitness for use—"the amount of air drawing ability is tested by standing in front with a piece of cloth."

H. L. McLean.

That Big Kick!

Out of control and spinning!
  You've tried all the stuff you know,
Used opposite stick and rudder,
  Tried working it fast—then tried it slow.
You've tried cutting down on the motor,
  Hoped that she'd lift the nose,
Chanced "gunning it" out with throttle;
  As the old earth begins to get close.

Then you were "set" for the big crash,
  With hardly a hope for the "breaks."
Pulled the belt a little tighter;
  Pushed the goggles from your face!
You've shut off the gas, you betcha!
  And cut out the switches, too,
They may gather you up in a basket,
  But cremation! not for you!

Now, with feet braced to the gas tank
  And arms ready to cover your head,
You've drawn down "into the office,"
  You've counted yourself out as dead.
You feel like a cheap second-rater,
  Not fit for a place in the game!
And Oh! how that gang in the hangar
  Forever will pan your name.

Wow! you can hardly believe it,
  As the nose comes high in the sky,
For the controls have a hold
  And she's soaring; and feelings like that don't lie.
So you hit her again with the motor
  And redress as you take command,
Oh! of all the wonderful feelings!
  There was never a kick half as grand.

A. A. C.

"Uh, Uh; Not Me!"

Co'se Ah ain't saying Ah won't do
Jes' what mah country wants me to,
But deys one job Ah fo'see
Ain't gwine to teach itself to me—
  Uh, Uh; not me!

Dat's dis heah aihrplane stuff—no, boss,
Ah'll bah some othah kind ob cross
Lak drove a mule, er tote a gun,
But Ah ain't flirtin' wif de sun—
  Uh, Uh; not me!

If Ah mus' do a loop-deloop
Let mine be 'roun' some chicken-coop;
It ain't gwine to be up whah the crows
Kin say Ah's trampin' on der toes—
  Uh, Uh; not me!

It sho' look sweet, Ah don't deny,
To be a ozzin' 'roun' de sky,
But dat's fo' folks dat's in de mood;
Not fo' me, tho' co'se Ah's shrewd—
  Uh, Uh; not me!

Down heah Ah firs' saw light of day,
Down heah am whah Ah's gwine to stay;
Folks, Ah don't keer to hab mah feet
Git too blame proud to walk de street—
  Uh, Uh; not me!

—Plane Talk.

Two squads of New York's finest had been dispatched to the scene of a riot in a section of the "Big Town" particularly well known for its "Tough Micks." Upon the return of the policemen the man at the desk at headquarters wanted to know why no prisoners had been brought back.

"There were three reasons why," spoke up the sergeant in charge.

"What three reasons?" roared the man at the desk.

"Two Irishmen and a pile of bricks," was the answer.

The O. O. D.'s messenger was going through a certain dormitory the other night looking for the relief of the clothes line watch.

"What's that you have?" inquired a voice from the dark.

"A searchlight," replied the messenger.

"What are you looking for?"

"Morning," was the answer.

"Stick around and it'll dawn upon you," suggested the voice from the dark.

When a certain aviation machinst's mate was asked if he had taken a bath, he inquired if there was one missing.

AERIAL AGE WEEKLY

OL. 14. No. 15 DECEMBER 19, 1921 10 CENTS A COPY



Independence Square, Philadelphia. Photographed by the Aero Service Corporation, Philadelphia

Program for Detroit Aerial Water Derby and Curtiss Marine Trophy

AMERICAN GEOGRAPHICAL SOCIETY

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MA[illegible] UE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4; Foreign, $6. Entered as secon-class matter, March 25, 191[illegible] ffice at New York under the Act of March 3rd, 1879

MADE IN ITALY—USED THROUGHOUT THE WORLD

Ansaldo S. V. A. Aeroplanes

Reliability—Speed—Economy

TO

AMERICAN ANSALDO ACHIEVEMENTS

ADD

FIRST PLACE—LARSEN EFFICIENCY CONTEST:

Winner Larsen Trophy and $3,000 cash. Model Nine two place SVA flown by Capt. E. F. White, carrying a useful load of 1,161 pounds first, junkers second and third.

FIRST AND THIRD PLACES AMERICAN LEGION DERBY:

First, Winner Legion Trophy and $3,000 cash. Ansaldo Curtiss Balilla flown by Lloyd Bertaud.

Third, Model Nine SVA, flown by Capt. Earl F. White.

FOURTH PLACE PULITZER RACE, 1921

Ansaldo Curtiss Balilla.

Note: The SVA Model Nine which won the Larsen Trophy and placed in the Legion Derby is a stock model.

A Demonstration Will Convince You

AERO IMPORT CORPORATION

1819 BROADWAY NEW YORK

WRIGHT PATENTS LICENSEE

December 19, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 15

TABLE OF CONTENTS

Government Aid to Civil Aviation 339
The News of the Week 340
Calendar of Coming Events..... 341
The Aircraft Trade Review..... 342
Correction of the Aerofoil Characteristics for Aspect Ratio..... 343
Performance Test of Spad 13 Equipped with 220 H.P. Wright Engine 344
Program and Conditions of the Detroit Aerial Water Derby, and Curtiss Marine Trophy..... 346
National Advisory Committee Makes Its Annual Report..... 347
The Maneuvers of Getting Off and Landing 348
Naval and Military Aeronautics... 351
Foreign News 352
Elementary Aeronautics and Model Notes 353
Aeronitis 354

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

This Pilot says:
"I have flown the Lincoln Standard over four States and consider it the best ship on the market. Its ability in tight places is wonderful."

Price $3985
F. O. B. Factory



Ted LeCocq, Pilot (at left)
D. Swanson, Mechanic
Flying Lincoln Standard Speedster

"Man-O-War"
Owned by Mr. Collins of
Collins Oil Co., Knoxville, Ia.

NEBRASKA AIRCRAFT CORP.
Lincoln, Nebraska

Curtiss



WORLD'S RECORD

"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

CURTISS AEROPLANE & MOTOR CORPORATION

GARDEN CITY LONG ISLAND, N. Y.

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., December 19, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, DECEMBER 19, 1921 No. 15

GOVERNMENT AID TO CIVIL AVIATION

WHEN Representative Hicks of New York introduced in the House recently his bill to establish a Bureau of Civil Aeronautics in the Department of Commerce he said that the European Governments were giving "their full co-operation and assistance" to civil aviation, and that it was now possible "to travel by air between all the principal cities of Europe at a cost which makes aviation a serious competitor of the railroads." The number of "air ports" built in Great Britain and on the Continent and planned for 1922 is a proof of progress in civil aeronautics that embarrasses Americans who are engaged in "promoting" companies to carry freight and passengers between the large cities "Where are your landing fields? How do you expect to accomplish anything until aviation is regulated by Federal legislation?" When these questions are put to them, they can only answer that they live in hope that the Hicks bill, or a similar measure, will soon be passed by Congress and be signed by the President.

Civil aviation is making headway in the United States, but slowly. At the end of November, the Navy Department made public an encouraging report of the trips or voyages made by the aeromarine-navy flying boats, which maintain a service connecting New York with Key West and Havana, New York with Albany by way of the Hudson, New York with New England ports, and Montreal along the Great Lakes to Chicago. While this service is experimental and as yet expensive, 1,044 passengers, 24,002 pounds of mail and 5,000 pounds of freight and baggage were carried 42,000 miles on six cruisers of the F-5-L type in the year ended Oct. 27, 1921. Six navy coast patrol boats carried 4,762 passengers 34,920 miles in the same period. No passenger or employé was injured. An S-2 air boat with 5 passengers flew completely round the Great Lakes, a distance of 7,491 miles. Planes of this service are often seen on the Hudson from the ferryboats. They are swift and powerful craft and move as steadily as launches on the surface of the river. In a letter accompanying the annual report of the National Advisory Committee for Aeronautics, President Harding says:

"Aviation is destined to make strides, and I believe that America, its birth-place, can and should be foremost in its development. I therefore urge upon Congress the advisability of giving heed to the recommendations of the committee, the first and foremost of which is that a bureau be established in the Department of Commerce for the regulation and development of air navigation."

The report of this committee, of which Dr. Charles D. Walcott, Director of the Smithsonian Institution, is chairman, declares that private enterprise would soon establish freight and passenger services in different parts of the country if landing fields, aerodromes and meteorological stations were made available by the Department of Commerce bureau which is proposed in the Hicks bill. "The first national airways," says the committee, "should be carefully planned to serve military as well as civil needs." It is also urged by the committee that the Government acquire the best helium-producing fields. America would then have, it says, a practical monopoly of helium, and no other nation could compete with it in operating airships for purposes of either war or commerce.

—Editorial in N. Y. Times.



The News of the Week



Harding Urges Bureau of Air Navigation

Washington.—President Harding transmitted to Congress December 7 the annual report of the National Advisory Committee for Aeronautics with the recommendation that a bureau for the regulation and development of air navigation be established in the Department of Commerce as proposed by the committee.

"I think there can be no doubt," the President stated in a message which accompanied the report, "that the development of aviation will become of great importance for the purposes of commerce as well as national defence. Aviation is destined to make great strides and I believe that America, its birthplace, can and should be foremost in its development.

"I therefore urge upon the Congress the advisability of giving heed to the recommendations of the committee, the first and most important of which is that a bureau be established in the Department of Commerce for the regulation and development of air navigation."

Oppose Aircraft Limit

Washington.—The American attitude toward military and commercial aviation appears to be that it should have unlimited development.

This attitude, it was learned December 7, was informally brought out in the first meeting of the conference sub-committee on aviation, in which the experts of the five powers took part. The instructions of the heads of the five delegations to the sub-committee were "to report on the number, character and use of aeroplanes." All the members of the sub-committee considered the instructions too brief and decided to ask the committee of five for more specific directions.

The general view expressed in the sub-committee was that as Secretary Hughes had said that the American plan for the limitation of naval armament did not provide for naval aircraft limitation, neither was it contemplated to limit army aeroplanes. That view was confirmed by the American members. It agreed with the French idea that as the production and use of commercial aircraft could not be limited, any more than any other means of transport or locomotion, nothing practicable could be done about military aeroplanes.

The aviation sub-committee will not meet again until directed to do so by the head of the delegations.

Aviators

To Cast Light 75 Miles as Guide to

The General Electric Company announced that between 8:30 and 9 o'clock December 8 it would begin experimenting with a 36-inch high intensity searchlight at Schenectady.

If the weather conditions are right, it is believed this searchlight will project a beam visible at a distance of seventy-five miles.

A 36-inch high intensity searchlight similar to those used in the navy stands stationary and plays directly on a mirror set at a 45-degree angle. From this angle the light is shot perpendicularly into the sky. By the movement of the mirror the beam acquires a rotary motion. The motion can be varied, and in this variation is found one of the practical applications of the beacon. The beam from a land lighthouse at Schenectady, for example, would have one movement and a light at Syracuse would have another movement. The aeroplane pilot, knowing the characteristic light movement of each station, would thus be able to pick his way in the dark.

The Union College Radio Club will cooperate with the engineers in making the demonstration, informing wireless amateurs throughout the State of the test and requesting them to report on the visibility of the beam from their points of observation.

Aircraft to Run on Sky Cable

London.—British aviation experts and capitalists have put their heads together on the proposition of perfectly safe airline travel, and the result is a proposed airship with a string to it. It is not on the kite principle, but what is proposed is that lines be built between large cities by which aeroplanes will be guided by cables about 400 feet in the air so that they will be sure to reach their destination and not be lost in the fog, as often happens nowadays.

The proposed airline has many advantages over unguided travel, it is declared, and is not so expensive as to be prohibitive. The "cars" could make 150 miles an hour with perfect safety, and this saving in time over rail travel would be an inducement to travelers. What is proposed is a heavy cable stretched between towers 400 feet in height. The "car" would run along this cable, being connected beneath the "car" so that it would provide a guide and keep the plane from shooting off at angles in heavy winds and also would prevent the pilot losing his way at night.

The plan is declared by the aviation experts to be perfectly feasible. The capitalists say the money can be provided as soon as it is seen that the scheme will draw a proper amount of traffic. In fact, it is declared that despite the cost of the towers and the cables it will be cheaper to build and maintain than a surface railroad of the same length. The plane will not rest upon the cable, but will be kept in the air by the wing spread and the momentum. The cable simply will keep it on the line. Also, it is possible, with the cable plan, to operate the line by electricity. The power being furnished through the cables from the huge power plant at some convenient point along the line.

The great speed proposed has its advantages, inasmuch as it would mean a great saving of time. A trip to Liverpool and return could be made in less than one-third the time now consumed, which would mean that a business man could go from London to Liverpool by way of the airline, attend to business that would consume several hours, then return to London in less time than is now required for the train trip one way. In America such lines would be of even greater value than anywhere in Europe. From New York to Chicago trains require 20 hours or more for the trip. Over the air line a business man could leave New York early in the morning, reach Chicago in six hours, attend to his urgent business and be back home in the evening for dinner and a visit to the opera.

This scheme is not at all visionary, the experts say, and they declare that plans are already under way that will result in the construction of such a line in this country as will be a model for similar lines in other parts of the world. The development of the aeroplane has been such in the past few years that they declare no one can yet see the limit of its possibilities. Air travel is so common in Europe at the present time that it is no longer considered a novelty. The chief thought now is toward greater safety.

Annual Banquet of the Aero Club of America

The fourteenth annual banquet of the Aero Club of America will be held this year in the grand ballroom of the Hotel Commodore, New York City, at 7:30 Monday evening, January 9, 1922.

The courtesy of the membership of the Aero Club of America has been extended by the Board of Governors for this day to the members of the Society of Automotive Engineers, Automobile Club of America, Automobile Club of New York, Motor Boat Club of America and the New York Yacht Club.

Members of the various clubs and their guests will be seated at the same and adjoining tables.

List of speakers and their subjects will be announced later.

The Banquet Committee consists of Mr. Benedict Crowell, Chairman; Messrs. Jas. A. Blair, Jr., Howard E. Coffin, Maurice Cleary, Cole J. Younger, Augustus Post, Arthur Scholle and Caleb Bragg.

Pulitzer Trophy Race

The Pulitzer Trophy Race next year will be held under the same conditions and over the course originally scheduled for Detroit in 1921.

Detroit Aerial Derby

The Detroit Aerial Derby will include all competitors for Aviation Country Club of Detroit Trophy, Liberty Engine Builders Trophy, Class Race Prizes and Invitation Races. The conditions for this event will be announced shortly.

Detroit News Aerial Mail Trophy

The Detroit News Aerial Mail Trophy for Multi-motored Aeroplanes, will be held under the same conditions and over the course originally scheduled for Detroit in 1921.

Speed Trials

Preparations will be made for Speed Trials over a kilometer course.

Bennett Balloon Race to Start From Geneva

Bern.—Geneva as the starting point for the 1922 Gordon Bennett balloon race has been practically decided upon by the Swiss Aero Club.

Bern has renounced her claim to the distinction, recognizing that the surroundings are not conducive to favorable takeoffs. Zurich had the start in the race of 1910.

Bomber Up 26,500 Feet

Dayton.—The feat of Lieutenant Leigh Wade, a test pilot at McCook Aviation Field, in reaching an altitude of 26,500 feet in a United States Army Martin bombing plane Dec. 8 was acclaimed by the officers at the field as demonstrating the practicability of daylight bombing. Henceforth,

they said, limited speed of the heavy planes and inability to reach high altitudes had led to the belief that only night bombing expeditions could be successfully conducted.

Following Lieutenant Wade's flight, during which he carried an observer, officers voiced the belief that he had established a world's record for a multi-motored plane with two occupants.

At an altitude of 26,500 feet, Lieutenant Wade said, his gasoline feed lines froze and he was forced to descend. A minimum temperature of 34.6 degrees below zero was registered. The flight occupied four hours.

Aeroplane Exports Decrease

In the November 28th issue of Commerce Reports, published by the U. S. Department of Commerce, it is stated that in spite of the fact that the commercial value of aeroplanes as a means of communication is realized more and more, and that air service all over the world is constantly expanding, exports of aeroplanes manufactured in the United States fell off considerably during October. A comparison of aeroplane shipments, excluding parts, for October, 1921, with those of September, shows a decrease of 88 per cent in number and 74 per cent in value; a comparison of the October, 1921, figures with those for October, 1920, gives evidence of a still greater decrease—90 per cent in number and 95 per cent in value.

Civil Aviation in Canada

The Air Board, Ottawa, Canada, gives a summary of civil aviation certificates and licenses issued, cancelled, renewed and still in force during 1920 and 1921.

During the year 1920, 10 applications were denied; 403 new certificates or licenses issued; 27 lapsed or were suspended; 23 were renewed; in force on December 31, 1920, 375.

During the period January 1, 1921, to October 31, 1921, no applications were denied; 244 new certificates or licenses were issued; 261 lapsed or were suspended; 117 were renewed, making the grand total of certificates or licenses in force on October 31, 1921, of 475.

New Aviation Bill Offered

Washington.—Legislation to carry the recommendations of President Harding with respect to creation of a bureau of civil aviation was introduced in the Senate Dec. 12 by Senator Wadsworth, Republican, of New York. The proposed bureau would be established in the Department of Commerce and be supervised by a commissioner, the object being to "encourage, foster and regulate" civil aviation.

The Wadsworth bill, together with a similar bill presented in the House by Representative Hicks, Republican, of New York, results from conferences between the representatives of the Aero Club of America, the aircraft industry and the heads of the army and navy air services, the weather bureau and the national advisory committee for aeronautics.

Four Engineering Bodies Honor Marshal Foch

When Marshal Foch reached New York Dec. 12 he was acclaimed as a fellow engineer by the organized engineers of America, who, at a ceremony in the Engineering Societies Building, 29 West Thirty-ninth street, conferred upon him the unique distinction of honorary membership in the four national engineering societies.

The event is without precedent in American engineering, no other man ever having been elected to honorary membership in all four of the founder societies, consisting of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. The presentation of the certificate of honorary membership was made in the auditorium of the Engineers Societies Building.

New Wireless Control Also Lands Planes

London.—In addition to controlling the flight of an aeroplane by wireless, attempts are being made in France to devise mechanism to enable a plane not only to ascend pilotless but also to land without any hand on the controls.

Devices in course of perfection show wonderful ingenuity. In one case a machine without a pilot, its engine having been started, runs across the aerodrome, causing to revolve at a rapidly increasing pace a small two bladed fan or screw between the wings. The fan as soon as it turns a certain number of revolutions actuates mechanism which places the control surfaces of the machine in the right position for ascent, its manœuvres while aloft being controlled by wireless.

When the time comes for landing the tap of a ground wireless key has the effect of unrolling beneath the aeroplane a length of wire with a weight at the end. This weight, touching ground while the machine is at some little height, switches off the engine and causes the rear surfaces of the plane to set themselves in such a position that the landing wheels of the machine make a smoth contact with the ground.

French wireless control of aeroplanes has achieved already a notable triumph. A large machine was taken up by its pilot, who left the controls and allowed the machine to be manœvred for more than an hour by wireless operators in a land station far below. At a given signal the pilot resumed control and landed.

Rockaway Naval Station Meets Another Obstacle

The Parks and Playgrounds Association, of which George Gordon Battle is President, added its protest to that of the Committee on Non-Partisan Facts against giving the Jacob Riis Park at Rockaway Point to the Government for a naval aviation station. The association contends that before the transfer is made the navy should prove that it is justified as an imperative necessity for proper national defense.

"The opportunity of the people of the City of New York for recreation and healthful exercise is already circumscribed by the limited amount of park area which is available for that purpose," says the association.

"The occupation of any part of this park by the navy as a naval air station may interfere with the utility of the rest of the park for the proper purposes of pleasure and recreation. The naval air station will be a source of constant danger to those who may use the area in its immediate vicinity as a pleasure ground. Even if the danger be regarded as more apparent than real the apprehension which is inspired in people generally by the presence of airships, with an occasional accident or mishap, is of itself sufficient to diminish, if not entirely destroy, the attractiveness of this seaside park as a place of resort.

"Our position is that since there are other available sites for the navy's purposes, since the Jacob A. Riis Park is not indispensable for the national defense, and since it is our duty to oppose any encroachment upon park space, we shall resist the navy's effort to obtain the Jacob A. Riis Park for aviation purposes."

CALENDAR OF COMING EVENTS
under saction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe
Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

Kimball Heads A. S. M. E.

The election of Dean Dexter S. Kimball of the College of Engineering of Cornell University as president of the American Society of Mechanical Engineers was announced December 7.

Dean Kimball took office at once, succeeding Edwin S. Carman of Cleveland, and will serve for one year. He heads an organization of 15,000 members with active professional divisions and local sections in every principal industrial centre in the country.

Other officers elected were: Vice-Presidents, Colonel Edward A. Deeds of Dayton, Ohio; Robert Sibley of San Francisco and Louis E. Strothman of Milwaukee; managers, Sherwood F. Jeter of Hartford, Conn.; Horace P. Liversidge of Philadelphia, Hollis P. Porter of Tulsa, Okla., and Walter S. Finlay of New York; treasurer, William H. Wiley of New York; secretary, Calvin W. Rice of New York.

With the election of Dean Kimball the society set in motion two important movements, one looking to world engineering unity and the other to remedy what the engineers say are deplorable conditions in the United States Patent Office, menacing American industry and invention. In the campaign for better Patent Office conditions the society will work with other national engineering organizations.

Vickers to Be Constructed in France

The Grand Express Aeriennes Company of Paris, have purchased the license to construct the Vickers Vimy Commercial in France, for commercial transportation.

S. A. E. Tachometer Standard Revised

The Aeronautic Division of the Society of Automotive Engineers Standards Committee has recommended that certain revisions be made in the present S. A. E. Standard for Tachometer Drive. These revisions are recommended because experience has indicated that the present standard dimensions for the shaft connection on the engine end are not of suitable proportions to insure freedom from trouble. This is especially true in the operation of the centrifugal type of tachometer which turns faster than indicated speed. Breakage has therefore resulted through the use of the present dimensions, even though special alloy steels have been used for the shaft.

The Aeronautic Division recommends an increase in the diameter of the driving shaft from 0.152 to 0.187 in. and an increase in the diameter of the hole for the driving shaft from 0.161 to 0.191 in. These recommendations will be acted upon at the next meeting of the Standards Committee on Jan. 10 in the Engineering Societies Building, New York City.

Sims Interests Ford in Making Aeroplanes

Detroit.—Henry Ford's next creation will be the "air flivver," according to reliable rumors in circulation in Detroit.

Intimations that the Ford Company intended to manufacture aeroplanes for commercial use, in circulation recently, became more positive as a result of the conference of Ford, Rear Admiral Sims and Thomas Edison at Dearborn on Dec. 7.

Rear Admiral Sims during his visit to Detroit emphasized strongly his belief that the aeroplane was the most important thing ever developed by man. He is said to have communicated his ideas to Ford, who requested that the Admiral remain in Detroit until Edison and Ford returned from Muscle Shoals.

W. B. Mayo, chief engineer of Ford enterprises, who is known as an advocate of aerial transportation, was also present at the conference.

Air Service Bids

Engine Parts—Procurement Branch, Air Service, Tempo Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 27, circular ASA-11, for furnishing large quantities of miscellaneous spare parts for Liberty engines.

Remodeling Oil Pumps—Procurement Branch, Air Service, Tempo Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 29, for remodeling oil pumps for Liberty engines.

Bomb Hoists and Control Handles—Air Service, Procurement Branch, Tempo. Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 17, for 20 universal bomb hoists and 400 bomb rack control handles.

Elastic Cords—Air Service, Procurement Branch, Tempo. Bldg. No. 6, Washington.—Bids are wanted until 2:30 P. M., December 28, circular ASA-19, for 2,000 ft. ½-in. shock absorber rubber, 5,000 ft. do, 5,000 ft. do, 3,000 ft. do, 1,000 ft. ⅝-in. shock absorber rubber and 2,000 ft. do.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, October 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT CO			
															Gallons of Gasoline	Total Time Run Hr., Min.	Total Miles Run	Cost per Hour
EASTERN New York-Chicago	$5,305.59	$970.88	$3,862.01	$4,707.87	$1,617.77	$794.50	$3,291.41	$1,667.40	$4,659.85	$5,828.93	$215.50	$3,029.70	$812.03	$36,763.44	14,785	495 24	45,205	$74.16
CENTRAL Chicago-Rock Springs	5,004.96	1,441.02	[a] $10,349.39	4,278.34	1,173.09	450.65	3,481.39	2,414.85	6,201.85	7,424.12	312.10	4,387.85	1,176.03	48,095.64	18,330	750 33	65,655	64.08
WESTERN Rock Springs-San Francisco	3,547.48	653.63	[b] 11,669.92	1,938.14	1,040.48	287.44	3,992.61	1,667.40	4,651.88	3,840.20	215.51	3,029.71	812.03	37,346.43	12,864	533 35	48,111	69.70
Totals and Averages	$13,858.03	$3,065.53	$25,881.32	$10,924.35	$3,831.34	$1,532.59	$10,765.41	$5,749.65	$15,513.58	$17,093.25	$743.11	$10,447.26	$2,800.09	$122,205.51	46,469	1,779 32	158.971	$68.58

a Includes new motor in Plane No. 71 and wings and tail section on Plane No. 260.
b Includes new motors in Planes No. 126 and No. 149.

TOTAL Operating Cost.....$122,205.51
Permanent Improvements..... 6,501.09

GRAND TOTAL.....$128,706.60

COST PER MILE			
Division	Overhead	Flying	Maintena
Eastern	$0.22	$0.24	$0.35
Central	.17	.19	.37
Western	.19	.18	.40
Entire Service	$0.20	$0.20	$0.37

Overhead consists of: Departmental overhead; office force and watchmen; motorcycl trucks; rent, light, fuel, power, telephone and water; radio; testing and experi work.

Maintenance consists of: Miscellaneous; mechanics and helpers; repairs and accessori warehouse.

Flying consists of: Gas; grease and oil; and pilots.

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

CORRECTION OF THE AEROFOIL CHARACTERISTICS FOR ASPECT RATIO

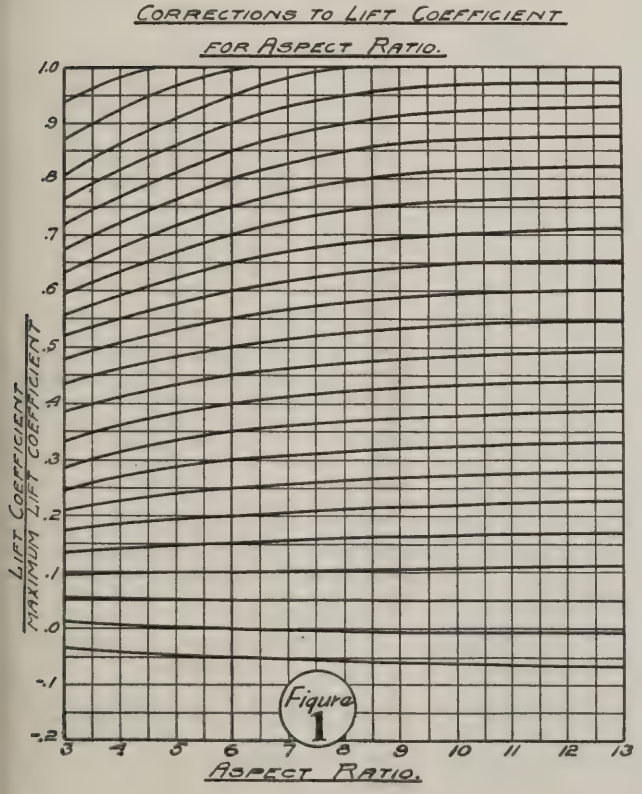
By B. V. KORVIN-KROUKOVSKY

M. Sc., Aeromarine Plane and Motor Co.

ASPECT ratio of the airplane wings varies from 4, in case of some monoplanes, to 13 in case of large flying boats. The models of aerofoils are usually tested in wind tunnel with the aspect ratio of 6. It is evident that, for the purpose of prediction of the performance of a new machine, the results of the wind tunnel test must be corrected for the aspect ratio, as well as for other conditions different from the conditions of the test. The correction for aspect ratio is commonly made by means of empirical curves given in the British Advisory Committee for Aeronautics Rep. & Memo. No. 450, which curves were derived from the results of experiments made by the National Physical Laboratory in 1912. Since the publication of the R. & M. No. 450, however, some additional information on the effect of aspect ratio becomes available, and it is the purpose of the present article to show that by the combination of this additional information with the empirical curves mentioned very good results may be secured.

The curves for correction of the lift coefficient for aspect ratio, shown on Fig. 1, are reproduced from the R. & M. No. 450. In order to use the curves it is necessary first to find the ratio of the lift coefficient to the Maximum Lift Coefficient of the wing under consideration, then start from the corresponding point on the vertical line of the aspect ratio of 6 and follow along the nearest curve up to the aspect ratio of the wing under consideration; at this point new value of the ratio Lc/Lc-max. can be read off the curve. Max. lift coefficient, multiplied by this ratio, will give corrected value of the lift coefficient. The ratios of the lift coefficients to max. lift coefficient were used in construction of these curves in preference to the lift coefficients themselves, because this renders the curves equally convenient for the use in case of wings with different values of the max. lift coefficient, and because it was assumed that the max. lift coefficient does not vary appreciably with the aspect ratio. The investigation of the pressure distribution along model wings, made later by the National Physical Laboratory, showed that the lift of the wing is approximately proportional to the (Aspect Ratio—0.42), (see R. & M. No. 575). On the basis of this information, correction of the max. lift coefficient for the aspect ratio takes the form:

$$\text{Lc-max. (corrected)} = \text{Lc-max. (original)} \times \frac{(\text{A.R.} - 0.42) \times \frac{6}{}}{\text{A.R.} \qquad 5.58}$$



Corrected values of all lift coefficients can be obtained by multiplying the max. lift coefficient thus found by the ratio Lc/Lc-max., corrected by means of the curves of Fig. 1.

In order to demonstrate the practical application of the correction, data of the test of R. A. F.-6a aerofoil (from R. & M. No. 148) are given in the Table I and are corrected to the aspect ratio of 13. Last column of the table contains the results of the actual test of the aerofoil of the aspect ratio of 13 (from R. & M. No. 439). Comparison of the last two columns of the Table I shows how high is the accuracy of the correction.

TABLE I

Angle of Attack	Lc Original	Ratio Lc/Lc—Max. Original	Ratio Lc/Lc—Max. Corrected	Lc Corrected	Lc A.R.=13 Observed
— 2	.010	.017	.006	.003	.005
0	.102	.175	.187	.114	.117
+ 2	.207	.355	.390	.237	.248
4	.284	.487	.532	.324	.322
6	.355	.607	.660	.402	.406
8	.424	.726	.794	.483	.487
10	.489	.838	.913	.555	.563
12	.551	.942	1.000	.608	.610
14	.584	1.000	....	....	....

$$Lc\text{-}max._{13} = \frac{13 - .42}{13} \times \frac{6}{5.58} \times \text{Lc-max.}_{6} =$$

$$1.04 \text{ Lc-max.}_{6}$$

$$\text{Lc-max.}_{13} = 1.04 \times .584 = 6.08$$

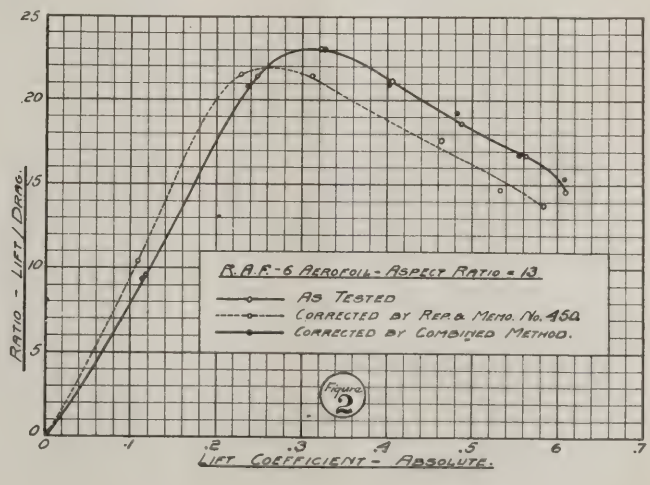
Dr. Prandtl showed that the drag of an aerofoil can be considered as composed of two parts: Drag due to the section proper, independent of the plan form of the aerofoil, and "Induced Drag," which depends on the plan form of the aerofoil and is parabolic function of the lift. The value of the induced drag coefficient (Dc-i.), if expressed as British or American absolute drag coefficient, takes the form:

$$\text{Dc-i} = \text{K Lc}^2, \qquad \text{where K} = \frac{2}{\pi} \times \frac{\text{A}}{\text{S}^2}$$

where A = wing area, and S = wing span. In case of the wing of rectangular plan form S^2/A is equal to the aspect ratio. It appears, however, that in practice the above formula gives exaggerated corrections, and that better results are obtained by applying to it the empirical coefficient of 0.8. Then, for the purpose of correction of the drag coefficient for aspect ratio, we write the value of K as:

$$\text{K} = \frac{1.6}{\pi \times (\text{Aspect Ratio})}$$

In Table II are given drag coefficients for the R. A. F.-6a aerofoil of aspect ratio of 6, and correction is made to the aspect ratio of 13. The procedure of the correction is as follows: In the first column of the table are given the angles of attack, and in the second column, corresponding drag coefficients for the aspect ratio of 6. The angles of attack are needed merely as reference numbers in order to take the



corresponding lift coefficients from the Table I, which are necessary for the calculation of the Induced Drag Coefficients. In third column induced drag coefficients are computed for the aspect ratio of 6, using *uncorrected* values of the lift coefficient. In fourth column are given differences between numbers in second and third columns, *i.e.*, section drag coefficients. In fifth column induced drag coefficients for the aspect ratio of 13 are computed, using *corrected* values of the lift coefficient. In sixth column corrected drag coefficients are given, which are obtained by mere addition of the numbers in fourth and fifth columns. In seventh column the values of the drag coefficient are given, as observed on the test of the aerofoil of aspect ratio of 6. It may be noted that agreement between calculated and observed values is very good.

TABLE II

For Aspect Ratio of 6, K = 1.6/3.14 ×6 = .0850.
For Aspect Ratio of 6, K = 1.6/3.14 × 6 = .0850.

1	2	3	4	5	6	7
Angle of Attack	Dc A.R.=6	Dc-i. A.R.=6	Dc-s (Section)	Dc-i. A.R.=13	Dc Corrected A.R.=13	Dc Observed A.R.=13
— 2	.0140	.0000	.0140	.0000	.0140	.0163
0	.0126	.0009	.0117	.0005	.0122	.0124
+ 2	.0128	.0036	.0092	.0022	.0114	.0112
4	.0170	.0069	.0101	.0041	.0142	.0140
6	.0235	.0107	.0128	.0063	.0191	.0193
8	.0313	.0153	.0160	.0091	.0251	.0262
10	.0413	.0203	.0210	.0121	.0331	.0333
12	.0506	.0257	.0249	.0145	.0394	.0415
14	.0619	.0290	.0329	.....	.....	.....

TABLE III

Angle of Attack	Lc	Dc	Ratio L/D	
			Corrected	Observed
— 2	.003	.0140	.21	.31
0	.114	.0122	9.35	9.50
+ 2	.237	.0114	20.8	21.4
4	.324	.0142	23.0	23.0
6	.402	.0191	21.0	21.1
8	.483	.0251	19.25	18.6
10	.555	.0331	16.75	16.7
12	.608	.0394	15.4	14.6

In the Table III corrected values of the lift and drag coefficients are summarized and the ratios of the lift to drag are computed for all angles. As before, the values of L/D as obtained from the test are placed in the last column of the table. Data from the last two columns are plotted for comparison on Fig. 2 against corresponding lift coefficients. It may be noted that although the values of L/D for any one angle of attack do not agree exactly, they are displaced in such a way that when plotted against corresponding lift coefficients, they form practically identical curve. The results of the correction by means of the data from R. & M. No. 450 alone are plotted on the same diagram and dotted line is drawn through the points thus obtained, allowing convenient comparison of this older method with combined method described above.

PERFORMANCE TEST OF SPAD 13 EQUIPPED WITH 220 H. P. WRIGHT ENGINE

Prepared by Engineering Division, Air Service, McCook Field, Dayton

Official Performance Test—Summary of Results

Aeroplane: Spad 13.
No.: P-154.
Type: I.
Engine: 220 H. P. Hispano-Suiza.
Propeller: S. C. No. 109778.
Equipped as: Single-seater pursuit.
Weight empty (including water): 1,464 pounds.
Armament and Equipment: 185 pounds.
Crew: 180 pounds.
Gasoline: 177 pounds.
Oil: 30 pounds.
Weight loaded: 2,036 pounds.
Weight per square foot: 9.5 pounds.
Weight per horsepower: 9.16 pounds.
Fineness: 104.

Standard altitude in feet	Climb				Speed		
	Time in	Rev. per min.	Rate ft./ min.	Flow gal./ min.	Miles per hr.	Rev per hr.	Flow gal./ hr.
0	0	2'040	1,200	.....	131.5	2,300	.....
6,500	6.5	2,040	810	.....	128	2,260	.....
10,000	11.5	2,040	600	.....	124.5	2,225	.....
15,000	23'	2,030	300	.....	117	2,140	.....
20,000	.....	.....	.....	.....	.....	.....	.....
25,000	.....	.....	.....	.....	.....	.....	.....
a18,400	42.5	2,020	100	.....	105	2,060	.....
b20,000	.....	2,010	..0	.....	89.5	2,010	.....

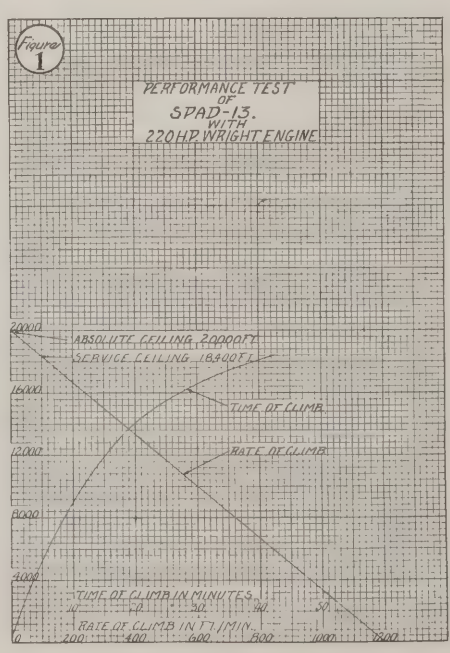
a Service ceiling; *b* Absolute ceiling.

Endurance, full throttle at 10,000 feet (including climb), 2 hours 30 minutes.
Minimum speed at sea level (lowest throttle), 65 m. p. h.
Landing speed, 59 m. p. h.

Pilot's Observations on Spad 13

This aeroplane taxies very easily even in a high wind, and has no tendency to turn in either direction on the ground. It should be taxied with the control stick held forward to lessen the weight on the tail skid. The tail skid is set too straight and has broken on two different occasions while taxying over rough ground.

It is a difficult aeroplane to take-off because of the tendency to swing to the right immediately upon opening the throttle, and if given left rudder too fast will swing to the left. In order to make a good fast take-off it is necessary to push the control stick slightly forward to raise the tail from the ground. This feature is noticeable after having flown other pursuit aeroplanes of approximately the same power.



In flight the aeroplane is very steady, but requires a good deal of left rudder, as the engine torque is very pronounced. It is tail heavy flying level, and also climbing with wide-open throttle, but this tail heaviness is not so pronounced above 15,000 feet.

The cockpit is very roomy, although the rudder bar is set too close to the pilot and tires the legs in a long flight. It is a very warm and comfortable aeroplane to fly altitude or on cold days, but not on warm days or low flying with wide-open throttle, such as contact patrol.

The aeroplane maneuvers easily and shows no tendency to spin in very tight banks. The visibility is good to either side and above the top wing, but is blind straight ahead and below.

The constant noise of the geared engine is very annoying and at altitudes above 16,000 feet the engine operates badly. The engine is very susceptible to temperature changes in a glide and cools quickly, so that the pilot must control his shutters constantly in changing altitude.

The engine is not very accessible for maintenance, and the installation could be improved.

This aeroplane lands easily, shows no tendency to turn on the ground, and stops short owing to the heavy tail. Even when landed tail high or on a rough field it does not show any tendency to nose over.

Description of Aeroplane

Dimensions

Over-all span: 26 feet 3¾ inches.
Over-all length: 20 feet 4 inches.
Over-all height: 7 feet 6½ inches.
Height at hub of propeller above ground:

In flying position: No propeller or engine in aeroplane.

Wings

Wing curve: Unknown.
Sweep back: None.
Dihedral degrees: None.
Stagger: 1¼°.
Gap: 3 feet 10½ inches.
Total area, including ailerons: 227 square feet.

Upper Wing

(Including center section.)

Span: 26 feet 3¾ inches.
Chord: 4 feet 7⅛ inches.
Area, with ailerons: Unknown.
Incidence, degrees: Upper, 1¼°; lower, 1°.
Span (from center section to wing tip): 13 feet 2 inches.

Lower Wing

Span: 26 feet 3¾ inches.
Chord: 4 feet 7⅛ inches.
Incidence, degrees: 1°.
Span (from fuselage to wing tip): 11 feet 2¼ inches.

Ailerons or Flaps

Number: 2.
Arrangement: On upper wing only.
Upper wing:
Length: 7 feet 3½ inches.
Chord: 1 foot 7½ inches.
Lower wing:
Length: None.
Chord: None.
Distance from longitudinal axis of aeroplane to center of aileron: 9 feet 4¼ inches.

Stabilizer

Span (maximum): 10 feet 2 inches.
Chord (maximum): 2 feet 3⅛ inches.

Elevator

Span (maximum): 10 feet 2 inches.
Distance from leading edge of elevator
Chord (maximum): 1 foot 8¾ inches.
to center of gravity of aeroplane: Center of gravity unknown.

Rudder

Height (maximum): 3 feet 10⅝ inches.
Chord (maximum): 2 feet 2 inches.

Fin

Height: 2 feet ⅞ inch.
Width (maximum): 3 feet 11¼ inches.

Fuselage

Maximum cross-section height: 2 feet inches.
Maximum cross-section depth: 3 feet inches.
Distance of maximum section from leading edge, lower plane: 3 feet 10 inches.

Landing Gear

Number of wheels: 2.
Tread: 4 feet 10¾ inches.
Shock-absorbing system: Rubber cord.
Braking device: Tail skid.
Wheels ahead of center of gravity: Unknown.

Distribution of Weights

[By pounds.]

Weight empty (with water): 1,464.
Armament and equipment: 185.
Crew: 180.
Gasoline: 177.
Oil: 30.
Weight loaded: 2,036.
Weight on front wheels (tail skid on ground): 1,714.
Weight on tail skid (tail skid on ground): 322.
Weight on front wheels (flying position): 1,826.

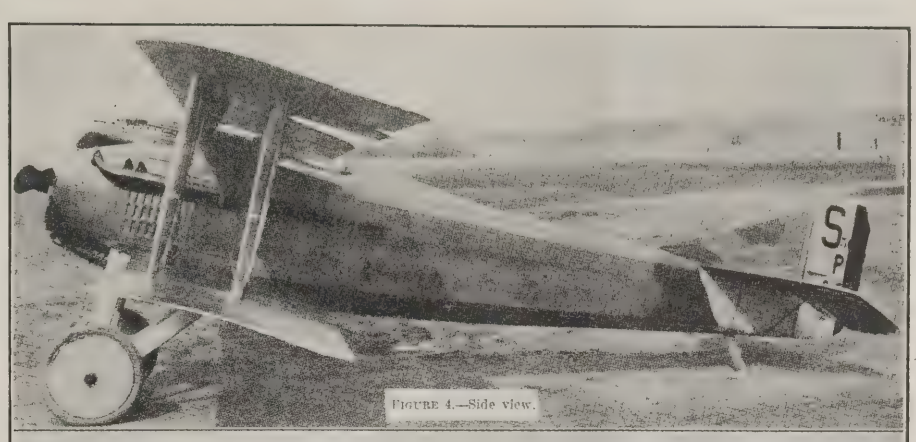


FIGURE 4.—Side view.

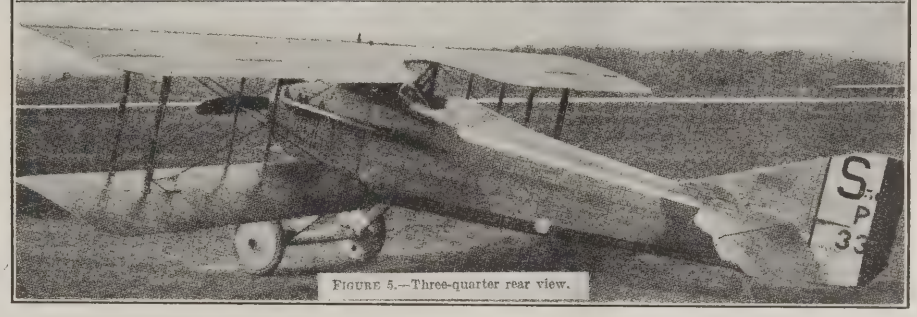


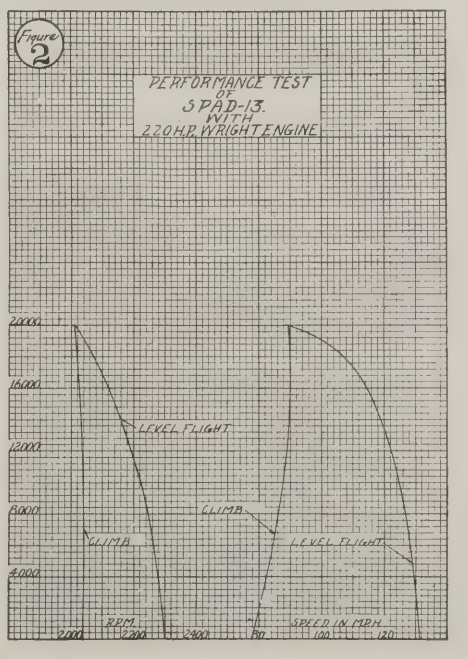
FIGURE 5.—Three-quarter rear view.

Weight on tail skid (flying position): 210.
Center of gravity (distance from wheels in flying position): 1 foot 5 inches.
Provision for special equipment not carried during test.

Description of Power Plant

Engine

Make: Wright.
Factory No.: 119908.
A. S. No.: 94888.
Type: Eight-cylinder "V"; 90°.
No. in plane: 1.
Location: Nose of fuselage.
Rated h. p.: 220.
Rated r. p. m.: 2,000.
Bore: 4.72 inches.
Stroke: 5.12 inches.
Compression ratio: 4.8 to 1.
Weight dry: 503.
Gas consumption: 0.472 pounds per h. p. hr.



Oil consumption: 0.02002 pounds per h. p. hr.

Ignition

Battery or magneto: Magneto.
Make: Magicienne.
Number: 2.
Advance, degrees: 26° and 27°.
Gap interrupter: 0.020.
Plugs, make: A. C.
Type: Metal body porcelain insulator.

Carburetors

Make: Claudel.
Type: Barrel butterfly.
Number: 1.

Radiators

Make: French.
Type: Ribbon.
Number: 1.
Position: Nose of fuselage.
Depth: 3⅞ inches.
Length: 2 feet 4⅝ inches.
Width: 2 feet 2⅝ inches.
Temperature adjustment: Vane shutters.

Exhaust Pipes

Description: Individual stacks on each cylinder merging into manifolds which extend to rear of cockpit.

Lubrication

Capacity oil tank: 4.5 gallons.
Type pump: Eccentric vane.
Wet or dry sump: Dry sump.

Fuel System

Number of tanks: Two; 1 main; 1 gravity.
Location: Main, rear of engine in fuselage entire system.
Description of fuel-supply system: Air-pressure system.

Motor Control

Description: Rod and lever.

Propeller

Make: Engineering division.
Number of blades: 2.
Diameter: 8 feet 2 3/16 inches.
Pitch: 7.26 feet.
Tips: Terne plate and linen.
Remarks: Made of walnut, left hand.

PROGRAM AND CONDITIONS OF THE DETROIT AERIAL WATER DERBY, INCLUDING THE CURTISS MARINE TROPHY; CLASS AND INVITATION EVENTS TO BE HELD IN DETROIT THE FIRST WEEK IN SEPTEMBER, 1922

Curtiss Marine Trophy

New Deed of Gift

1. The trophy shall be perpetual and competed for annually by seaplanes and flying boats.
2. The contest shall be in the nature of a race either around a closed circuit or from point to point. The rules governing the race each year to be drawn up by the Contest Committee of the Aero Club of America.
3. The trophy shall be awarded each year to the Aero Club represented by the pilot of the winning machine, and this Club shall be entitled to the possession of the trophy until one month prior to the next succeeding contest, at which time the trophy shall be returned to the Aero Club of America. The Contest Committee of the Aero Club of America, with the consent of the Board of Governors, has the privilege of conducting each annual contest for the Curtiss Marine trophy, or of assigning this privilege, under sanction, to any other club or organization.

Conditions of Contest

1. *Free-for-All for Flying Boats and Seaplanes,* having

   (a) Factor of safety (monoplanes: six) as loaded for start of race; (biplanes: four) as loaded for start of race.

   (b) Air speed greater than 70 miles per hour, as loaded for start of race.

   (c) Visibility and maneuverability (water and air) which in opinion of Contest Committee, Detroit Aviation Society, is not a menace to the other contestants or spectators.
2. *Distance, Approximately* 160 *Miles.* Eight times around a closed course of 20 miles.
3. *Rules of the Race.*

   (a) Upon receiving the gateway signal for the start, pilots shall hold a straight course and not cross or attempt to cross in front of the planes on either side.

   (b) From a standing start contestants will fly around the first four laps of the course, but during the last four laps will be obliged to alight on the water and while running along the surface of the water enter into and pass through, in the proper direction, the water controls which shall be designated by moored markers on both sides. After passing out of a water control, contestants must take the air and fly at least one-half the distance to the next water control.

   (*Note.—There will be two or more water controls on each lap and at least one will round a turning mark.*)

   (c) While within the markers bounding the water controls, the contestants must maintain constant contact between the water and fixed surfaces of the principal flotation gear (wing or tail pontoons; or water rudder, or any other adjustable, movable or flexible attachment is not sufficient contact with the water, under this rule).

   (d) A plane overtaken, both planes being in the air, must hold its altitude and a true course, in order that it may not in any way impede or interfere with the faster overtaking plane.

   (e) A plane overtaking a slower plane, both planes being in the air, shall never pass or attempt to pass between that plane and any pylon or object used to mark a turning point.

   (f) Within the water controls, both planes being on the water, the overtaking plane must pass to the left, and all mechanicians of competing planes must look to the rear and warn pilots of an overtaking plane. Pilots of overtaken planes must keep to the right and give the faster overtaking plane room to pass on the left.

   (g) The finishing line must be crossed in flight—not on the water—and after crossing the finishing line, all planes shall continue on their course until they have attained sufficient altitude to enable them to turn and land without crossing the course or finishing line.

   (h) No contestant shall start before he receives the getaway signal.

   (i) Pilots shall pass outside all turning points and in plain view of officials stationed at each point, and at an altitude of not more than 250 feet.

   Fouling a Mark. "Any competitor who has failed to turn a stake properly may validly continue on the circuit provided he makes a complete turn of the said stake and then continues his trip in the same direction." F. A. I. Rules, Art. 115.

   (j) No contestant shall be permitted to "dope" the fuel with picric acid, ether, or similar highly explosive liquids. Benzol and similar anti-knock fuels may be used.
4. *Start.*

   (a) The starting signal will be given at ——— A. M. Planes to be in their allotted places at ——— A. M. Pilots' meeting for the final instructions to be announced later.

   (b) Position at start. Planes competing for class and invitation prizes in addition to Curtiss Marine Trophy will be sent away together in a class, the faster classes starting before slower. Competitors for Curtiss Marine Trophy only will be sent away together after the classes.

   (c) Method of starting. Contestants will be lined up along the shore in shallow water for the start. The starter will assign an assistant starter to each plane who shall raise the signal flags for its pilot, as follows: The starting signal (for motors only) a red flag will be raised by the chief starter at —— A. M. When the motor of each plane is running, the assistant starter assigned to that plane will raise the red starting flag. When all assistants have raised the red starting flags, but not later than —— A. M., the starter will raise, in addition to the red starting flag, the white warning flag, which signifies that the getaway signal will be given in ten seconds; each second will be counted by lowering the red flag, the getaway signal being the lowering of both red and white flags. If any contestant has difficulty in starting his motor, his assistant starter will not raise the red starting flag, but, when the chief starter raises the white warning flag, will raise a blue flag, which is a request for a deferred start. Deferred starts shall be granted without penalty, except that no plane will be started after a delay of two hours.
5. *The Finish.*

   The finishing time will be taken when each plane flies across the finishing line between the marks defining this line, after having completed the full course, 160 miles.
6. *The Winner.*

   Of each first place shall be the pilot which has completed the full course in the shortest elapsed time, and of each second place, the second best time, etc., provided the pilot is not disqualified. The Curtiss Marine Trophy will be awarded to the club represented by the pilot and the prize money paid to the entrant of the winning seaplane or flying boat. Agreements between pilots and entrants as to their portional share of the prize money will be upheld up the Contest Committee, who will pay the prize money in accordance with agreements in writing between pilots and entrants, presented to the Contest Committee prior to the race or within 24 hours after the finish of the race.
7. *Qualifications.*

   No seaplane or flying boat may take part in the contest unless it is piloted or commanded by a pilot, who must be on board and who must be furnished with a license issued by the Contest Committee of the Aero Club of America (F. A. I. Rules, Art. 67). Every person furnished with Pilot's certificate of F. A. I. may obtain license issued optionally by Contest Committee, Aero Club of America (F. A. I. Rules, Art. 70). A license will be valid until the 31st December of the current year. The Contest Committee, Aero Club of America, may, upon the occasion of any competition or test, issue temporary license as pilot for this one test only to any person whose qualifications it considers sufficient (F. A. I. Rules, Art. A-28).
8. *Disqualifications.*

   Any contestant breaking the above rules of the race, or subsequent ones which may be sent out in writing, shall, upon recommendation of the judges, be disqualified.

   "Every person organizing or taking part in a sporting event of whatsoever nature, is supposed:

   (1) "To know the present regulations (F. A. I. Rules) thoroughly.

   (2) "To agree to submit without restriction to the consequences that result therefrom" (F. A. I. Rules, Art. 7).
9. *Protests.*

   No protest shall be considered unless presented in writing to the Contest Committee of Detroit Aviation Society within twenty-four hours after the finish of the race (F. A. I. Rules,

Arts. 78, 79, 80). (Appeals. See F. A. I. Rules, Art. 178-179.)

10. *Numbers.*
Each plane shall have the number assigned to it by the Contest Committee painted on the bottom surface of lower wing and on each side of the fuselage, clear of the wing, in characters as large as possible. It shall have no numbering over twelve inches in height.

11. *Advertisements.*
"Competitors are forbidden to display on their apparatus or material any commercial advertisement except the trade-mark of the constructor of the apparatus" (F. A. I. Rules, Art. 89).

(*Note.—The word plane as used in these rules means flying boats or seaplanes.*)

Additional Prizes

1. The (to be announced later) prizes for greatest air speed will be awarded to the contestant who, during the Curtiss Marine Trophy race, completes laps 2, 3 and 4 in the shortest total elapsed time. (The first lap is not included because of the standing start.)

2. Additional prizes will be awarded for Class or Invitation races to be announced by the Contest Committee of the Detroit Aviation Society after entries have closed.

(a) *Class Races.* Four or more planes of the same design and equipped with the same motor shall constitute a class.

Class Rule. Planes eligible for class races are those constructed under the same design and general specifications and not altered to materially change these specifications, nor to prevent the interchange of any corresponding part or parts of any two planes.

Furthermore, should any interchange of corresponding part or parts be directed under this rule, the plane must remain the same after the interchange from the standpoint of design and operation.

Exceptions. Stream lining which does not alter the structure of the part or parts stream-lined.

Motors eligible for class races are determined by the above rule and these exceptions:

(1) Stream lining which does not alter the structure of the part or parts stream-lined.

(2) Motors may be equipped with any make or design of propeller, ignition, spark plugs, carburetor, including intake manifold, exhaust manifold, gasoline and oil systems.

(b) *Invitation Races.* The Contest Committee of the Detroit Aviation Society may invite any of the entrants to compete for a special prize.

Entries

Free entries close July 31, 1922.

25% penalty entries close August 7, 1922.

50% penalty entries close September 13, 1922.

The entry fee, $100, will be refunded if the contestant is in his allotted place ready to start in the contest, provided the entry is received before July 31st. Entries received after July 31st but prior to August 7th will be penalized $25. Entries received after August 7th but prior to September 13th will be penalized $50. After September 13th entries will only be accepted with the written consent of all other entrants and the entry fee of $100 will not be refunded.

NATIONAL ADVISORY COMMITTEE MAKES ITS ANNUAL REPORT

PRESIDENT HARDING, in a special message to the Congress forwarding the annual report of the National Advisory Committee for Aeronautics, says that America should be foremost in the development of aviation. He thinks there can be no doubt that the development of aviation will become of great importance for the purposes of commerce as well as for national defense. After pointing out that aviation has not been extensively developed in America, because of lack of wise and necessary legislation, he urges that this condition be remedied by the creation of a bureau in the Department of Commerce for the regulation and development of air navigation.

In its annual report, the National Advisory Committee for Aeronautics urges the enactment of legislation for the devlopment of aviation and for the establishment of airways and airdromes under Federal regulation. The Committee expresses the opinion that if this is done, air lines for the transportation of passengers and of goods will be rapidly established by private enterprise in all parts of the country. The Committee points out, however, that the first transcontinental airways should be carefully planned to serve military as well as commercial needs. The extension of aerological service under the Western Bureau, and the adoption of a policy to sustain and stabilize the aircraft industry, are again urged by the Committee. The continuation of the Air Mail Service under the Post Office Department is recommended until, by the enactment of appropriate legislation, it will become possible for commercial air lines to operate air mail routes. The Committee also recommends the development of airships and the utilization of a small amount of helium at this time, and urges conservation of the great existing resources for future use.

Following is the President's letter transmitting the report to Congress:

To the Congress of the United States:

In compliance with the provisions of the Act of March 3, 1915, establishing the National Advisory Committee for Aeronautics, I transmit herewith the Seventh Annual Report of the Committee for the fiscal year ended June 30, 1921.

I think there can be no doubt that the development of aviation will become of great importance for the purposes of commerce, as well as for national defense. While the material progress in aircraft has been remarkable, the use has not as yet been extensively developed in America. This has been due, in the main, to lack of wise and necessary legislation. Aviation is destined to make great strides, and I believe that America, its birthplace, can and should be foremost in its development.

I therefore urge upon the Congress the advisability of giving heed to the recommendations of the Committee, the first and most important of which is that a bureau be established in the Department of Commerce for the regulation and development of air navigation.

WARREN G. HARDING.

Summary of General Recommendations

The general recommendations of the National Advisory Committee for Aeronautics as contained in its Seventh Annual Report to the Congress are summarized as follows:

Legislation for the Development of Aviation

The most urgent need for the successful development of aviation at the present time, either for military or civil purposes, is the enactment of legislation providing for the Federal regulation of air navigation, and the establishment of airways and airdromes under Federal regulation. The Federal regulation should include the licensing of aviators, aircraft and airdromes; the airways should consist of chains of landing fields providing supply and repair facilities and including the necessary meteorological stations, observations, and reports. If the Federal Government will establish and regulate transcontinental airways as recommended, the committee is confident that air lines for the transportation of passengers or goods will be rapidly established by private enterprise in all parts of the country. The first national airways, however, should be carefully planned to serve military as well as civil needs. The committee reiterates its former recommendations as to the manner of accomplishing the desired results, and urgently recommends the establishment by law of a Bureau of Air Navigation in the Department of Commerce.

Extension of Aerological Service

The committee emphasizes the importance of extending aerological service under the Weather Bureau along airways as established, and recommends that adequate provision of law be made for this service which is so indispensable to the success and safety of air navigation.

Policy to Sustain the Industry

Whatever may have been the faults or the shortcomings of the aircraft industry during or since the war, the fact remains that there must be an aircraft industry, and that it should be kept in such a condition as to be able to expand promptly and properly to meet increased demand in case of emergency. The Government, as the principal consumer, is directly concerned in the matter, and should formulate a policy which would be effective to sustain and stabilize the aeronautical industry and encourage the development of new and improved types of aircraft. In this respect the committee invites attention to the recommendation contained in its special report submitted to the President on April 9, 1921, published as House Document 17, and again recommends the adoption of a policy which, while safeguarding the interests of the Government, will tend to sustain and stabilize the industry.

Importance of Military Aviation

Aviation is indispensable to the Army and to the Navy in warfare, and its relative importance will continue to increase. Other branches of the military services are comparatively well developed, whereas aviation is still in the early stages of its development. The demand for greatly reduced expenditures in the military and naval services should not apply to the air services. The committee recommends that liberal provision be made for the Army and Navy Air Services, not only

(*Concluded on page* 351)

THE MANEUVERS OF GETTING OFF AND LANDING*

By SQUADRON LEADER R. M. HILL, M.C., A.F.C.

PART III.—LANDING

1. Factors Which Particularly Influence "Landing"

(*Concluded from page* 302)

(*g*) The low undercarriage, although it may reduce the angle of the wings to the ground, tends to bring them closer to it. H. Glauert in R. & M. 667 does not seem to attach much importance to the effect of a low wing position, at any rate, for reducing the run. It has been a matter of flying experience, however, that certain aeroplanes whose lower planes were close to the ground, within half a chord, were notably easy to land. The wings definitely felt as if they cushioned against the ground and the aeroplane did not appear to drop a wing so easily. This may have been in some part due to the fact that the proximity of the wing to the ground made it easier for the pilot to judge his height prior to contact; but the fact remains that it was a widely expressed opinion. The couple tending to put the nose down due to cushioning has not, as in getting off, been sensibly noticed by pilots. A large angle of the wings to the ground undoubtedly does reduce the run of the aeroplane, but in landing the pilot feels it more difficult to get his tail down, neither is his position so comfortable, as the nose tends to rise up in front of him and block the view ahead.

(*h*) It is naturally essential for the pilot to have a good view during both phases of landing—as he is gliding down in the approach, as he makes contact, and during the subsequent run. As he approaches, he must be able to see if the landing space ahead is clear, or otherwise he is timid and uncertain in his preliminary maneuvers. When he is about to make contact with the ground, it is unwise to try and gauge the height of the aeroplane from the ground by looking down steeply over the side, and worse still to look back at portions of the aeroplane such as the wheels, even should they be visible. Among other things, his sense of lateral balance is certain to be upset. He should look at the ground about fifty yards ahead, at which distance it does not appear to be moving very rapidly, relate its appearance to the general perspective of objects towards the horizon, and thus judge his attitude relative to the ground. If he looks down at the ground rushing past near to him, its apparently rapid movement tends to unbalance his judgment.

In a few aeroplanes, while the view downward is good, the view forwards is restricted too much by the spar of the top plane being brough too near the level of the eyes—with the object of allowing the pilot to look over it. For landing, he is compelled to look downwards rather than forwards and his judgment is interfered with.

Although experienced night-flying pilots can land at night with little or no illumination, the average pilot needs a set of flares, unless he lands down the beam of a strong searchlight. He has to concentrate not on where he supposes the ground to be, but on the perspective of the flares; when they become nearly superimposed he flattens out.

Within limits the pilot accommodates himself easily to landing large aeroplanes in which his seat is a large vertical distance from the ground. Experience seems to indicate that the lower the pilot is, the easier it is for him to land; but it has not proved how high the pilot can be seated without encountering real difficulty.

Provided the pilot is not at an abnormal distance from the C.G., for landing the position of his seat does not appear to affect him much. If he sits behind the planes, the consciousness of them assists his judgment; on the other hand, his view is so much better if he sits in front that by losing the first advantage he gains the second. It is, however, always helpful to have some sort of fairing in front of him which will assist his idea of the attitude of the aeroplane.

2. General Notes on Landing

In the earlier days of flying the modern "tail down" landing was seldom, if ever, practiced. The aeroplane was glided down, and in case of such scouts as then existed, at an excessive speed for fear of stalling; after which the pilot attempted to run along the ground with the tail up, allowing it gradually to sink down as the aeroplane slowed up. Such landings were nearly always associated with violent bounces, due to uneven ground, and corresponding risk of damage. War conditions forced the pilot to change his attitude. If aeroplanes were to be landed on soft or rough ground in confined spaces, the problem of landing would have to be more finely appreciated. And it was. Consequently the practice was made of getting the tail right down before making contact with the ground, and was not after all found so risky as had been supposed. The risk of dropping a wing, as time went on, was further diminished by better design.

Supposing for the moment that the pilot makes a straight approach to the landing space, he may have some latitude both in the line of his flight and in a lateral direction as to where he may safely make contact so that his subsequent run may be all on good ground. But when, travelling at a minimum of 60 m.p.h., he views the landing space from the air, it looks surprisingly small and gives him an unpleasant sensation of constraint. If the lattitude as to where he may touch the ground in the line of his flight is 300 yards, the maximum period he will have in which to make up his mind is roughly 10 seconds, after which time he will have overshot his mark; or alternatively, assuming a gliding angle of 1 in 6, he must judge his height over an obstacle within 150 ft. The flatter the gliding angle of his aeroplane, the more will this margin contract. As a matter of fact, the pilot very seldom attempts to judge a straight up-wind glide; he approaches the landing space with a margin of height, and loses it by a series of maneuvers which will be discussed later.

Associated with the tail up landing practiced in earlier days was a kind of rapid flattening out. The aeroplane was glided down and, until it was within a few feet of the ground, flattening out was postponed, and was correspondingly violent. The pilot then allowed the wheels to touch and so ran along until the aeroplane came to rest. This kind of flattening out, however, can be made in conjunction with a tail down landing, which means that the pilot keeps the aeroplane near to the ground without making contact until it stalls. The greater the speed at the time of flattening out, the longer the period before contact with the ground. This holding the aeroplane near to the ground is a severe tax on the pilot's mental concentration, as the flying qualities change with the loss of speed and the controls require the most delicate handling. If the pilot becomes fatigued, he lets the aeroplane either touch the ground too soon or curve up into the air again and stall too high.

Most pilots therefore try to diminish the period close to the ground by commencing to flatten out at from 20 ft. to 30 ft. up, thus approaching the ground more gradually. If the pilot could fortell the precise moment at which the aeroplane was in a suitable condition for contact with the ground, he need never consciously hold the aeroplane near to it; in practice he dare not risk such an accurate forecast, and always tries to allow at least a small period to elapse while he holds the aeroplane very close to the ground, awaiting the final condition of stalling. Pilots often refer to this as "flying the aeroplane right out." In forced landings the pilot may elect to bring the aeroplane in so slow and right on the edge of his controlling powers, that the period referred to becomes sensibly zero. But should his judgment be in the slightest degree out, a crash is inevitable, especially as he may have no engine to accelerate him at the last moment.

The normal gradual flattening out may actually be associated with a maneuver such as turning or side-slipping, by which it is apparently masked; but the pilot must so arrange the maneuver that a form of flattening out is really inherent in it.

In landing, as in getting off, the pilot is concerned with three things: his attitude, the horizontal component of his velocity relative to the ground, and the vertical component; the relative magnitude of which two components determines his gliding angle. The pilot arrives at a point from 20 ft. to 30 ft. above the ground, gliding at some speed at which he has a reasonable margin of control. From this point his path becomes curved; at any moment the lift of the aeroplane is just greater than the weight, and immediately prior to contact with the ground, the vertical component of his velocity should be reduced for a perfect landing nearly to zero. Now, neglecting the effect of the propeller, there are two factors which influence the control movement necessary to produce the required path. Firstly, the stalling moment necessary to be produced by the elevators; and secondly, the negative acceleration at any moment during the time that the attitude of the aeroplane is changing; for as the speed drops, the resistance at any moment changes. At some moment prior to stalling, the aeroplane may pass through an attitude of minimum resistance. This attitude, on the other hand, may be that corresponding to the speed at which the aeroplane is gliding when the flattening out commences; in most cases it is probably in the neighborhood of this speed.

Suppose that the aeroplane is initially gliding at its best gliding angle, that is, with minimum resistance; and suppose the speed which corresponds to this is 60 m.p.h. The subsequent curvature of its path will be associated with the alteration of

* Lecture delivered before the British Aeronautical Society.

its attitude and its corresponding loss of speed, the whole being made to culminate in the desired conditions just prior to contact with the ground. The pilot, by the use of his elevators, has to ensure that speed is gradually and steadily diminished throughout the curved path, and this dictates his attitude. Immediately the pilot commences to flatten out the aeroplane, which is assumed to be gliding at its best angle at 60 m.p.h., he will drop the speed. But at this lower speed the resistance will increase, and progressively so towards stalling. So to produce the curvature of path that he desires, the speed must decrease more and more rapidly as the ground is approached, and the attitude of the aeroplane must be altered to correspond, or the pilot will fly into the ground. The pilot does allow for it by a progressively more decided use of the elevators. As it happens, he has to use his elevators more decidedly as the speed drops, for two reasons: firstly, for the one mentioned, and secondly, because as the speed drops the control becomes increasingly less effective. It is, of course, by his sense of the rate of approach of the ground that the pilot allows for all these somewhat complex effects. It is emphasized here that the progression is all towards using the control more decidedly as the stall is approached.

But now suppose that the pilot, possibly for fear of stalling the aeroplane because he is being bumped about on a rough day, glides the same aeroplane in at 75 m.p.h. The resistance at 75 m.p.h. is greater than at 60 m.p.h.; so if his path is straight, the vertical component of his velocity is greater. When he commences to curve his path, the approach towards the attitude of minimum resistance requires a progressively less vigorous control movement to flatten the aeroplane out relatively to the ground; but there will come a critical time when the attitude of minimum resistance is passed and it becomes steadily greater. It is here that the pilot is likely to be deceived. The fall of resistance and the sensitiveness of the control at the higher speed, at first seemed to stave off the approach of the ground with a negligible effort on his part. After the critical point, he suddenly finds himself into the ground with a violent bounce, because he has not allowed for the more rapid decrease of speed. It is suggested that the above may be an explanation of why the pilot so often tends to fly into the ground if he glides in fast, that is, at a speed greater than that which corresponds to the attitude of minimum resistance or best gliding angle. On the other hand, the effects described above are probably masked in many cases by the stability characteristics of the aeroplane.

Whether the pilot curves his path gradually over a long period, or suddenly over a short one, the above remarks apply in the main. Th advantage of not having to hold the aeroplane close to the ground for a protracted period, while it "flies itself out," is seen to be that the consequence of a slight error in the allowance for the change of the vertical component of the aeroplane's velocity is not so likely to be followed by a violent bounce. More times than not, a pilot involuntarily performs the high-speed rapid flattening out type of landing through an ungovernable shrinking from a reduction of speed, especially when the air is disturbed. In reality the type in which he gradually flattens out is his ideal of good style. As in all fiying, violent control movements, unless dictated by imperative conditions, are the result of subconscious timidity or uncertainty of the pilot.

H. Glauert states in R. & M. 667 that a reversible airscrew would be of the greatest assistance in reducing the space required for landing. As long as the success of a landing is so intimately bound up with an exquisite kind of judgment, it would be difficult for the pilot to operate any kind of auxiliary control once he came under the influence of the ground, however useful it might prove in reducing the landing space. H. Glauert further points out that a reversible airscrew would not be available in the case of a forced landing without engine. It might be added that the pilot would be precluded from using his engine to increase the curvature of his path, should he need it at a critical moment.

If there is a wind, the pilot always lands against it. Just as the wind gradient near the ground assisted him in getting off, it disturbs him in landing. If the pilot lands against a strong head wind, he often, as he approaches the ground, feels himself unaccountably dropping. This must in many cases mean that he tends to lose speed without realizing it, due to the drop in the velocity of the wind near ground level. With the exception of this effect, there is nothing to fear from landing into a strong wind, as the actual speed of the wheels relative to the ground when contact is made is very low, and the subsequent run correspondingly short. It is a curious fact that when landing into a strong wind pilots so frequently tend to make contact with the ground with the tail up. This must be because they feel themselves travelling so much more slowly relatively to the ground that they are led into believing that stalling speed has been reached and that the aeroplane is ready for contact with the ground.

Although it has been pointed out that the pilot nearly always loses height near the edge of the aerodrome by maneuvering as a matter of course, these maneuvers will be considered in the paragraph dealing with forced landings, in which they are the decisive factor. Landing across wind, although sometimes deliberately practised, will be dealt with in a similar way. Landing down wind is not considered, as a modern aeroplane cannot be landed down a wind of any strength without the most severe risk of a crash. Furthermore, there seem to be no particular methods by which the pilot can diminish this risk.

3. "Landing" as a Forced Maneuver

Engine failure in the air means a forced landing, which, as has been stated before, is usually taken as the ultimate test of the pilot's skill and judgment. Sometimes the pilot is able to avail himself of a small amount of engine, which, though it will not enable him to climb up and try a second landing should he misjudge at the first attempt, serves to prolong his glide. The breakage of any essential part of the engine usually means switching it off altogether. If such a breakage occurs on a twin-engined aeroplane, unless the pilot can stop the propeller of the damaged engine, he will probably find it necessary to glide down as quickly as possible owing to the liability of very severe vibration being set up and the consequent menace to the aeroplane structure.

As in getting off, it is usually the obstacles which surround possible landing spaces that constitute the difficulty; so, especially if the gliding angle is flat, the pilot must, if for no other reason, have recourse to maneuvers to bring the aeroplane to the ground as soon after the obstacles as possible.

Engine failure may occur either at the beginning of the third phase of getting off, when the wheels have just left the ground, or towards the end of the third phase; or when the pilot is well up and free from the influence of the ground. In the first case the pilot is compelled to effect a landing immediately in his projected line of flight, trusting that he will not overrun the limits of good ground before coming to rest. Landing under these circumstances is difficult to execute without very severe bouncing and consequent risk of damage. The pilot finds himself somewhere near his best climbing speed, close to the ground, with the slipstream effects suddenly eliminated. Depending on how close he is to the ground, there are two courses open to him. If he is only 3 ft. to 6 ft. up, he may, without moving his longitudinal control, allow the aeroplane to sink on to the ground, due to loss of engine power, and trust that it will make contact more or less in stalling attitude. If, however, he is 20 ft. to 30 ft. up, he may attempt to put the nose down and induce a kind of glide from which he may hope to flatten out in the usual way. He must remember that the aeroplane will be sluggish in answering to the longitudinal control, that after engine failure it will begin to sink rapidly, and that if it answers sluggishly to the longitudinal control and only starts putting its nose down as it approaches the ground, there is no hope of flattening out; it were better that the pilot had attempted to keep flat from the moment of engine failure and trusted that the stalling moment of the elevators would be sufficient to hold in check the nose-diving couple until the wheels touched. Just whether or not the pilot will decide to put his nose down when the engine fails close to the ground is a critical test of his judgment.

If the engine fails towards the end of the third phase of getting off, the pilot has to choose between going straight on or attempting a backward turn. This has been discussed in Part II., para. (3). It was noted that if the pilot does elect to turn back, it is safer to dive and gain speed before commencing the turn than to commence the turn and try to gain speed while turning. It was a part of the teaching of the Gosport School of Special Flying, which initiated the modern conception of aerial maneuver, that if the engine failed and the pilot judged that he could turn back, it was safest for him to dive down and carry out the banked turn with his inner wing tip close to the ground. If then at any moment his available margin of speed disappeared, he could effect a landing without the risk of a nose dive.

Lastly, if the engine fails when the pilot is well up, the first phase of landing may be said to commence when he puts the nose down and commences to glide. From this moment he maneuvers for position by gliding towards the most open-looking stretch of country. On the whole it is not worth while, except in a very wide sense, selecting a landing place from above 5,000 ft., as local features are too obscure; and once the pilot has committed himself to the idea of landing in one place, it is disturbing to be compelled to change his mind later on. If possible, the pilot should attempt to arrange his glide so that he will pass over the selected landing place at an altitude not exceeding 2,000 ft., to enable him to make one good inspection. This he can do by gliding over it down wind. After that the general idea will be to approach the landing space with a margin of height to avoid the risk of undershooting, and lose this height by maneuver. Every pilot has

some particular way of maneuvering to lose height that he considers safest and most efficacious.

The simplest way, if the field has breadth at right angles to the wind direction, is to make use of this breadth by approaching the field just short of one edge at right angles to the wind. The pilot has then a certain latitude of time in which he can turn up wind, during which time he is losing height and is yet within range of the landing space. He can further assist his rate of losing height before turning up wind by sideslipping in the down wind direction. The wing farthest from the landing space will then be depressed, and the turn up wind will help him off the sideslip, as in itself it ensures the lifting of the depressed wing in order to bank for the turn.

A method of losing height that was in greater vogue formerly than to-day was to approach the landing space with a margin of height and then lose it by a series of partial turns, first one way and then the other, usually termed S-turns. This method enables the pilot to lose height quickly, but it has disadvantages. Firstly, by the complication of the maneuver, the pilot tends to become confused in sense of direction; and secondly, it is difficult to execute turns with the engine off without unconsciously increasing the speed, due perhaps to the pilot's instinctive fear of lateral instability at low speeds.

A modification of this method gives a still more rapid method of losing height. Instead of carrying out properly banked S-turns, the pilot does flat turns, yawing the aeroplane violently from side to side, up to as much as 60 or 70 degrees from his line of glide. For each flat turn he gives a turning impulse with the rudder and uses the ailerons against instead of with it, allowing the yawing moment due to the ailerons to increase the flat turn; which virtually amounts to letting the aeroplane take charge and then recovering. The aeroplane loses height with surprising rapidity, but the margin of control is too small for anyone but an extremely skilled pilot to practise this maneuver.

A method which has the advantage of being a steady, even maneuver is the "sideslip" landing. It commends itself as being effective, reasonably safe and not liable to confuse the pilot, who simply puts one wing down and maintains a steady sideslip, varying the steepness according to the rapidity with which he wishes to lose height. It is an advantage if he allows the aeroplane to slew slightly, so that as he glides down the depressed wing is forward of the raised wing; for the nose of the aeroplane is then not in front of his eyes as he looks down at the place he intends to land on, and allows him a particularly good view. When the aeroplane approaches the ground the pilot straightens it out and effects a landing in the ordinary way. A perfectly clean recovery from such a sideslip is not unattended with difficulty, and the pilot may find himself drifting sideways, due to imperfect co-ordination of his controls. Most undercarriages will not stand up to lateral loads of any magnitude, and it is peculiarly important that the pilot should make contact with the ground without drift. As a last resorce, the pilot can drop one wing, thus causing sideslip the opposite way in order to neutralize the drift. If he does this with skill, he will effect a landing on one wheel without damage. After running a few yards, the aeroplane will sink down on its other wheel and come to rest in the normal way.

The above methods of approach have been detailed separately; the actual practice of pilots is very difficult to analyze; the way in which an experienced pilot loses height is frequently a combination of feature peculiar to these methods that is influenced by local conditions, because every forced landing in a confined space surrounded by obstacles is a different problem.

The pilot may sometimes be compelled to land across wind if the landing space is narrow and the wind is blowing across it. He therefore finds himself drifting badly as he approaches the ground. The most effective way of neutralizing this is by the method referred to, *i. e.*, dropping a wing and landing on one wheel. There is still another method, which consists in putting on full rudder at the last moment before contact and inducing a flat turn towards the down wind direction, which has the effect of causing the aeroplane to skid sideways in the up wind direction and of tending to neutralize the drift. Owing, however, to the uncertain action of the rudder at such a low speed, this method is generally less effective than the previous one. Neither method, of course, is resorted to unless it seems likely that the undercarriage will collapse sideways if the drift is not neutralized.

On lightly loaded aeroplanes it is sometimes possible to make a very slow landing by producing a sideways skid close to the ground with the rudder and making a recovery just before contact, but on heavily loaded ones it is almost impossible.

If the pilot finds that he is running into bad ground towards the end of the second phase of landing, he attempts to spin the aeroplane round on the ground with the last of his rudder control. An emergency device on the tail skid, in the form of a sprag, might be of use under these conditions. Its braking action could be made so severe that the ground would be torn up and the rear of the fuselage possibly damaged. It would never be used under normal circumstances, but it might be useful in preventing the aeroplane colliding with an obstacle at the last moment, or turning over on its back in bad ground at the end of its run.

Should the pilot be compelled to land on undulating ground, a comparatively steep uphill gradient is easier to land on than even a gentle downhill one, unless the aeroplane has efficient wheel brakes. In order to land uphill, the pilot must leave himself a greater margin of speed with which to flatten out; the actual flattening out will also have to be of a violent nature.

In making a forced landing without engine from a great height the pilot's difficulties of judging the landing are increased. As he glides down he thinks in terms of thousands of feet, and, if he has no chance of flying round for a short time low down, he finds it difficult to think in terms of inches, just prior to contact. If he misjudges his glide he may have to pass over obstacles at a dangerously low speed, and as he finally approaches the ground he will find that the vertical component of his velocity is very large. The best thing for him to do is to concentrate the whole of his flattening out in a violent jerk at the last moment, using his elevator control to the full extent rather than attempt a gradual flattening out. Similarly, if he is compelled to glide at a very low speed to reach the safe landing place, he must practise the greatest economy with his control movements; the slightest unnecessary control movement means loss of height which he cannot afford when he is trying to eke out to the uttermost his fast disappearing margin of control.

Finally, if the pilot is compelled to approach ground on the surface of which it is impossible to make a landing in the accepted sense of the word, he will do best to keep a good margin of speed and control until the last moment, when he can expend this by pulling the nose up with a violent jerk, trusting that he will drop flat before the nose-diving couple comes into play. If he remains sufficiently cool, it should be possible for a pilot, keeping his speed till the last moment and then jerking the aeroplane up on its tail, to place it on the sloping roof of a house. A longitudinal shock is bound to injure the piloth; if remembering that his wings will absorb a shock of extreme violence, he can avoid colliding with an obstacle nose on, he may then hope to escape severe injury. A simple example of this is the contrast between striking a tree nose on and allowing the nose of the fuselage to pass between two trees and so taking the whole shock on the wings.

There is a certain point after which it is impossible not to wreck the aeroplane; pilots so often lose their lives and those of their passengers in attempting the impossible by overstepping the margin of speed and control of the aeroplane in the vain attempt to bring it down intact; in other words, once the pilot has decided that it is impossible to save the aeroplane, he must simply regard it as a shock absorber, and crash it, so far as possible, with the minimum risk to his crew.

NAVAL and MILITARY AERONAUTICS

Sergeant Chambers' Record Parachute Jump

Commenting on the parachute jump from a height of 26,000 feet made by Sergeant Chambers, U. S. Army Air Service, at Kansas City, on November 1st, and the fact that, during the course of his descent, he lighted and smoked a cigarette, a British aeronautical journal states that "while this is doubtless a record it is very unconvincing, and is about on a par with the "record de loopings" so much sought after by certain aerial acrobats; both of which are more tests of physical fitness rather than of aeronautical progress. When one has heard that someone has jumped 26 feet and landed safely, and not smoked a cigarette whilst on duty, then perhaps parachutes will be regarded as aerial 'life-belts' and not as aerial trapezes."

A Dayton, Ohio, paper considers that "the exploit, merely as a record breaker, means nothing. A fall of one-tenth, even one hundredth part of the distance, would be fatal. Altitude merely increases the certainty of mutilation, not the chance of escaping death or injury. But as showing the efficiency of modern parachutes and thus indirectly increasing the safety of the aeroplane, the record is of great value. The aeroplane probably never can be made perfectly and entirely safe any more than the automobile can be made safe against falling off bridges or upending in ditches, or the ship safe against going to the bottom when it is not watertight. But the parachute, in the sense that lifeboats and life-preservers help to make voyages on water less unsafe, is a valuable adjunct to the airplane. Its development to the point of the safety offered by lifeboats and life-preservers will hasten not a little the period of general use of the aeroplane as a practical utility for pleasure or commerce."

Night Flying at Kelly Field

Preparations have been made at Kelly Field, San Antonio, Texas, for night flying, beginning the early part of December, if conditions permit. The new Xbia planes, attached to the 13th Squadron for service tests, will be used. Almost all known tests have been applied to these ships, except cross country flying and their manoeuverability in muddy landing fields. Captain Lloyd L. Harvey, the squadron commander, has requested permission to fly one of these ships to El Paso, Texas, on cross-country, and it is thought that this trip will complete the required tests. A number of suggestions for improvements have been received from the officers who have flown these ships, the most prominent among them being the provision of some means of eliminating the excessive friction in the ailerons and elevators.

An Aeroplane Flight to Tall Volcano

On September 28th two aeroplane formations, led respectively by Major A. H. Gilkeson, Commanding Officer of Clark Field, Pampanga, P. I., and Captain Lloyd N. Keesling, Field Adjutant, flew on mapping and practice reconnaissance missions to Los Banos and Santa Cruz on Laguna de Bay, approximately eighty miles south of Clark Field. Both flights made side trips to Taal Volcano, which was enthusiastically reported on upon the return of the flights as being unique in geological formation and its beauty of environment. History records severe eruptions as having taken place as late as 1754. Captain Keesling mentions it in his reconnaissance report as a monument to the past ages of indiscribable destruction and ruin.

The approach to the volcano is over extremely rough and heavily covered country. Lake Taal, which entirely surrounds the mountain like a broad moat, is then reached. From this Taal Mountain rises probably a sheer five hundred feet, appearing from the side like an inverted cone, its apex broken off, and vertically from the air like a huge doughnut. Within the crater, which is estimated as being half a mile in diameter, lies an emerald green lake and still within this lake lies another small island. The sides of the cone are devoid of all vegetation. The peaks bordering the crater lake are irregular and sharply jagged. First Lieutnant C. L. Webber, who visited the location on the ground, reports Lake Taal as abounding in fish and, incidentally, less attractive forms of tropical life.

Langley Field Times

The Langley Field Times celebrated its third anniversary on December 3, and we extend to its editors our cordial congratulations on their success in getting out a really worth while service publication. More power to them!

Major A. G. Fisher Receives Promotion

Major Arthur G. Fisher, Commanding Officer of the Airship Section, Langley Field, has received notification of his promotion to Lieutenant-Colonel. Col. Fisher's commission will date from last April.

Helium Filled Airship Visits Langley Field

The U. S. Navy Airship C-7, the first airship to use helium gas, flew over this section and landed at Langley Field, Thursday. The capacity of the C-7 is 181,000 cubic feet.

The Naval officers in charge of the ship say that a high degree of efficiency was attained with the helium gas, but that the lifting power of the ship is not so great as when filled with hydrogen gas. The advantage in using helium gas is greater safety as it is non inflammable and will not explode. The envelope of the C-7 contains practically all of the world's supply of this new gas. A plant for producing helium is being installed at Langley Field and when completed will be one of the two helium producing plants in the United States, the other will probably be located on the Pacific Coast.

National Advisory Committee Makes Its Annual Report

(*Concluded from page* 347)

that provisions be made for the maintenance and training of personnel, but also that the funds be adequate to insure the fullest development of aviation for military and naval purposes.

Scientific Research

Substantial progress in aeronautical development, whether for military or commercial purposes, must be based upon the application to the problems of flight of scientific principles and the results of research. The exact prescribed function of the National Advisory Committee for Aeronautics is the prosecution and coordination of scientific research, and, while encouragement may be taken from the progress made, greater provision for the continuous prosecution of researches on a larger scale is strongly recommended by the committee.

The Air Mail Service

The Air Mail Service has demonstrated that airplanes can be utilized with certain advantages in carrying the mails. And it has done more than this, despite the handicap of using military types of aircraft, poorly adapted to its work or to any civil or commercial purpose in demonstrating that commercial aviation for the transportation of passengers or goods is feasible. There are several causes which are delaying the development of civil aviation, such as the lack of airways, landing fields, aerological service, and aircraft properly designed for commercial uses. The Air Mail Service stands out as a pioneer agency, overcoming these handicaps and blazing the way, so to speak, for the practical development of commercial aviation. As a permanent proposition, however, the Post Office Department, as its functions are now conceived, should no more operate directly a special air mail service than it should operate a special railroad mail service, but until such time as the necessary aids to commercial aviation have been established it will be next to impossible for any private corporation to operate under contract an air mail service in competition with the railroads. The National Advisory Committee for Aeronautics therefore recommends that provision be made for the continuation of the Air Mail Service under the Post Office Department.

Helium and Airships

The United States has a virtual monopoly of the known sources of supply of helium, and these are limited. Experiments have been conducted by the Bureau of Mines with a view to the development of methods of production and storage, but as yet the problem of storage in large quantities has not been satisfactorily solved. Because the known supply is limited, because it is escaping into the atmosphere at an estimated rate sufficient to fill four large airships weekly, and because of the tremendously increased value and safety which the use of helium would give to airships, particularly in warfare, it is, in the opinion of the National Advisory Committee for Aeronautics, the very essence of wisdom and prudence to provide for the conservation of large reserves through the acquisition and sealing by the Government of the best helium-producing fields. Attention now being given to the development of types of airships to realize fully the advantages which the use of helium would afford should be continued. Such development would give America advantages, for purposes either of war or commerce, with which no other nation could successfully compete.

FOREIGN NEWS

Canadian Activities

A draft plan for the training of university cadets by the Canadian Air Force, and by that means providing a reserve of flyers and areonautical mechanics in case of need, has been submitted by the Air Board to the various heads of universities in Canada for consideration and comment. The plan includes the giving of a three months' course for three consecutive years to university students who are desirous of studying aeronautical engineering where they can secure first-hand information. The number taking the first course, which is proposed for opening about May 1, 1922, will be limited to 30. Students must be under 21 years and unmarried, and physically fit for military service.

At the request of the Department of Militia and Defence, a complete aerial survey has been made of the Petawawa Military Reserve, comprising approximately 240 square miles. Photographs were taken from a Bristol fighter at an altitude of 8,000 feet, giving a mosaic 1/8000, which when completed and mounted on beaver board was twelve by fifteen feet in size. It was afterward reduced by the Department of Militia and Defence to a scale of 1/20,000. The photographs turned out remarkably well and all concerned expressed satisfaction, as full details were given in all sections of the photographs to enable an accurate map to be made. Six hundred feet of film, giving approximately 600 exposures, and about fifteen actual flying hours were required for the purpose of obtaining the pictures.

Inauguration of the Peking-Tsinan Air Service

Brilliant sunshine and a great crowd of Chinese, foreign guests and interested onlookers witnessed the inauguration recently of the Peking-Tsinan Aerial Service. As became such an epoch-making event, the ceremony was planned on an elaborate scale by the Chinese Aeronautical Department, a special pavilion being erected for the speech making, which was later used for a tea party after the first machine had taken to the air enroute for Tsinan. Incidental music furnished by the band of the Ministry of War enlivened the proceedings at intervals. On the invitation of the Department of Aeronautics, many persons were taken up for flying trips on a Vimy-Commercial piloted by Captains Lewis and Jones. Lieut. T. Y. Chen, flying an "Avro," was the stunt artist of the afternoon. Promptly at 4:45 P. M., the Cheng Ku (the name of a Vimy Commercial aeroplane) left the airdrome for Tsinan, carrying a full load of passengers and 600 lbs. of mail, destined for all parts of the world. Major Batterson (the senior pilot at Nanyuan) was in the cockpit with Lieut. Tsao. The passengers included Colonel Holt, D.S.O., C.M.G. (Adviser to the Aeronautical Department), representatives of the Aeronautical Department and Chinese Post Office, and several newspaper correspondents.

Addresses were made by General Yin Chang (representing the President), General Mo Tsun-chin and General M. K. Ting (Director of the Aeronautical Department). A message from Premier Chin, expressing his pleasure at the opening of the Peking-Tsinan Air Service, was read by General Shu Chin-Yuan.

Air Lines in Portugal

The government has received an application from a Paris group asking for a grant for fifty years to establish aeroplane lines between Lisbon, Oporto, Madrid and Paris.

Chinese Aeronautics

General Pan Chu Ying, the newly appointed Director of the Aeronautical Department, assumed his official duty on July 15th.

Mr. T. H. Chang, a returned Chinese student from the United States, has been engaged by the Aeronautical Department as pilot instructor in the Nanyuan Flying School. He is a graduate of the Virginia Military College and has received a complete course of instruction in Aeronautics in the Diggins Aviation School. He has passed the examination for International Pilot's license.

The section between Peking and Tsinan of the Peking-Shanghai Air Line has been carrying mails regularly since July 1st. It is now planned to carry passengers also, the fare for a single trip, either direction, being $50.

On June 27th, a "Vimy-Commercial" named in Chinese "Ta Peng" or "Great Bird", had two trial flights between Peking and Tsinan, a distance of 180 miles, without accident. In spite of the rather rough weather, the machine accomplished her maiden trip between these two points in 2 hours and 15 minutes. The return trip from. Tsinan to Peking occupied 3 hours and 15 minutes, its progress being retarded by a strong northern gale.

The Chinese Government has recently issued a set of five special postage stamps for use on the Peking-Shanghai air line.

Swiss Aeronautics

The Federal Aerial Office has issued a notice to the effect that, by order of the German Department of Transportation, aeroplanes of a military type constructed in Germany are no longer permitted to circulate in the air over that country. This prohibition also applies to civil aeroplanes registered n Switzerland but belonging to the aeroplane types prohibited in Germany, provided their papers do not contain a special certificate having come from the German Minister of Transportation stating that they were constructed before Jenuary 10, 1920.

A new air service which completes the connection between London and the Swiss winter resorts was opened by a French firm recently. The new air line runs from Paris to Lausanne. At present it is necessary for passengers leaving the Croydon airdrome at London by one of the air expresses to spend the afternoon and night in Paris, leaving for Lausanne next morning. It is, however, hoped to so arrange the service ultimately that the whole journey can be completed on the same day, with just a short stop at le Bourget (Paris).

Government Interest in Siam

It appears that the Government of Siam is taking considerable interest in aviation. Recently, it is reported, airdromes have been opened in various provinces, and machines are being or are to be imported from France and England to Bangkok. As the roads are not of the best, aeroplane services should have the effect of speeding-up considerably the inter-communication between the various provinces.

Traffic in the Netherlands

From a traffic point of view it appears that Amsterdam has become the third largest air station. During the period between April 14 and October 3, no fewer than 1,000 machines passed in and out of the station and carried—in addition to large quantities of goods and mail—1,511 passengers.

Subsidies by France for Civil Aeronautics

In 1921 France granted a sum of 27,885,008 francs in bonuses and subsidies to aerial navigation companies for working the following lines:

Paris-London; Paris-Brussels-Amsterdam; Paris-Strasbourg-Prague-Warsaw; Toulouse-Rabat-Casablanca; Bayonne-Nilbao-Santander; Bordeaux-Toulouse-Montpellier; Saint Laurent-Cayenne, and Saint Laurent-Inini.

For the year 1922 these lines are to be continued, and the following additional lines opened:

Antibes-Tunis; Bucharest-Constantinople; Oran-Casablanca; Algiers-Biska; Dakar-Kayes; Montpellier-Marseilles-Genoa.

This accounts for an increase of 9,137,000 francs in subsidies. The remainder of the subsidies requested will go to Civil Centres of Training for reserve pilots. Excellent results have been achieved by these Training Centres.

British Aeronautics

Of the 27 machines turned out by the Aircraft Disposal Company, Ltd., for the Spanish Government, and which were to have been flown to Spain, 22 have arrived successfully. The remainder were damaged through forced landings due to minor defects, compelling the pilot to land on some impossible country over which they had to pass. Taking into consideration the fact that these were not special machines but merely disposal stuff which had been standing idle for two years or so, and that owing to the urgency with which they were required they were hurried together without time for special tuning, this feat is considered quite noteworthy.

A large aeroplane, which has been undergoing speed trials at Farnborough for the past few weeks, will probably be put through a full test very shortly. This machine is the biggest in the Royal Air Force. With its twin Siddeley-Deasy engines it can develop nearly 1,000 h.p. It has fighting turrets on each side of the fuselage, with provision for machine gunners and bombers. In the trials it will probably carry a crew of ten, which, with the weight of the machine and its complement of guns, will bring the gross weight to something like ten tons.

Croydon Aerodrome (London) has now a fresh point of interest for the visitor. The Air Ministry authorities have erected a large map showing the airways of Europe in black lines. Along these routes, at intervals representing ten miles, are nails on which small models of aeroplanes, marked with the sign of the respective companies, are hung. When a machine leaves Croydon, or is signalled as having left another aerodrome for Croydon, its representative is placed on the map. An attendant moves it along the route from time to time, its progress being worked out by means of a knowledge of the speed of the machine. As many aircraft are now fitted with wireless, the pilot will signal down his position from time to time so that the position of the model on the board may be checked. Already firms, and friends of passengers, are finding the map of great use, while visitors to the aerodrome appear very interested in watching the progress of the machines which they have seen leave.

The Air Conference

The British Air Ministry announces:

The first Air Conference proved so useful in focussing attention on the many and intricate problems of aviation and in bringing about a frank exchange of views on the subject, that the Air Council has decided to call together another conference. This second air parliament will be held by permission of the Lord Mayor and Corporation at the Guildhall on February 7 and 8, 1922.

The Conference, which will be opened by the Lord Mayor, will, on this occasion, be asked to address itself mainly to the question of the future of aviation, with special reference to its development as a regular and speedy form of commercial transport.

At a matter of convenience the papers will be divided into two main groups, the one dealing with civil aviation in general and the other with technical problems, the papers on the former subject being delivered at the morning session of the first day, and the papers on the latter during the afternoon session of the same day. The proceedings on the second day will be devoted wholly to discussion arising out of the previous day's papers, the morning sessions being allotted to civil aviation and the afternoon to discussions on the technical papers.

There will be two chairmen; the Secretary of State for Air, who will preside during the civil aviation portion of the proceedings, and Lord Weir of Eastwood during the technical sessions.

The principal paper on civil aviation will be read by Lord Gorell, Under Secretary of State for Air, who will give a general account of progress at home and abroad, and will direct attention to a consideration of the ways and means whereby the development of civil aviation at home and in the Empire may be best furthered; in this connection Lord Gorell will endeavor to enlist the practical cooperation of business and other interests.

The main technical paper will be read by Mr. F. M. Green, of Sir W. G. Armstrong, Whitworth Aircraft Limited; the names of the other speakers will be communicated later.

In order that the Conference may be fully representative of all sections of the community who are now interested in the development of aeronautics or who are considered to have a potential and growing interest in air transport development, special invitations are being issued to all coming within these categories, particular efforts being made to secure, so far as possible, the attendance of representatives of large business groups and organizations.

Arrangements are being made which will permit all members of the Conference who desire to do so visiting the London terminal aerodrome at Croyden on Monday, February 6th. The operations of the various Continental air transport companies will then be seen and explained; in addition, as many types of civil aircraft as possible will be concentrated at Croydon to afford members an opportunity of seeing for themselves the range which is being covered by commercial designs. Demonstrators of amphibian aircraft alighting on the Thames will also take place during the period of the Conference.



An Analysis of Soaring Flight

By A. O. Henirich, Member of the L. I. Flight Association

FOR a long time I have been very much interested in the flight of birds, particularly in the gliding flight of the larger soaring birds. I have given quite some time to the study of these birds whenever opportunity offered, and have tried to discover the secret of their soaring flight with the object in view of applying it to an apparatus capable of carrying a man and staying aloft for long periods if not a more or less indefinite time.

From what I have been able to learn I have formed two conclusions: either the secret of soaring flight is so complicated as to be beyond the grasp of human brains and hands, or it is so simple that its very simplicity has blinded our eyes to the exclusion of this much sought-after power. Of the two opinions I am much more inclined to the latter for a great many reasons, some of which I will mention:

In the first place we must not take for granted that all we see a bird do or fail to do while in the act of soaring as any proof that it is or is not capable of doing the reverse or the same for a longer or shorter period of time if it so wishes. We must bear in mind at all times that birds are not (at least in most cases) performing for their own sport or edification, and that they are not, for instance, trying to stay aloft for a great time without a single wing flap, but in most cases are either in search of food or are travelling from one place to another and are therefore following the line of least resistance, so to speak, and will either travel entirely by soaring or by flapping flight or by both, as may best suit their needs and present conditions. Also the fact that a soaring bird will, at irregular intervals, resort to a slow flap or more while in the act of soaring, does not show that it was absolutely necessary to prolong the flight, for I do not think there is enough actual power derived from some of these wing strokes to be of any material benefit to the forward motion of the bird and certainly not enough to help it through any gusts or turbulent air. I do think, however, that the half dozen or more quick flaps are for the purpose of helping it through a downward trend or to make better headway against a gust. In the first case the bird does not want to lose altitude, and in the second does not want to lose its forward speed, and that either could have been actually dispensed with if the bird so desired so far as the elongation of the flight was concerned. I may be altogether mistaken in this belief but do not think so, as I am very much of the opinion that any of our best soaring birds (if they so desired) could stay aloft for a more or less indefinite period without a single wing flap in almost any kind of weather. As I said before, I believe that the act of soaring is much more simple than some of us may think and can be largely if not altogether imitated by man in a properly designed and suitably constructed apparatus handled in such a way as to get the most power out of the internal forces of the wind. I do not believe that a bird, for even a short time, searches for or tries to use any power it may get from an upward trend or column of warm or any other kind of air, and think we should leave such thoughts out of our calculations when dealing with soaring flights of either a mechanical or natural nature. Here again I may be mistaken and will welcome any proofs in contradiction of this view.

It has long been my belief that a bird soars very much if not quite after the manner in which a sail boat is propelled by the internal forces of the wind and by no other method. Just as we can sail a well-balanced boat in any direction, so can a bird sail in any direction and so can a well-balanced and properly handled soaring machine be made to sail, and for periods of as long or short a time as we choose to make them. In the case of a boat we have the water which floats the apparatus and holds it more or less in balance. The sail is very much like the wing of a bird or plane, but is in a vertical position. The force of the wind in this sail or wing creates a strong pressure which tends to push our boat sidewise or before it, at the same time pushing or pulling it forward. The hull resists the sidewise motion somewhat and the boat moves forward, but with some sidewise way on as well. If we consider the wings of a bird or a soaring apparatus as a sail, but in a horizontal position rather than a vertical, the same forces would be brought to bear, only in this case we must have our plane light enough so that the wind can lift it and it must be much more delicately balanced than the sailboat. In this case gravity, acting on the weight of our machine, would act in pretty much the same way as our boat in the water, as the weight of our machine would hold it from going backward, while the same force of the wind which tends to push sidewise would in this case act as direct lift and also tend to pull the machine forward, and by proper handling we could stay in the air and travel in any direction without much loss of altitude the same as the soaring bird.

The flight of the soaring birds can be successfully imitated by man, as mentioned before, if my opinion that the act of soaring is simple rather than complicated, but we must have a machine in which many of the following features are essential if not quite indispensable:

First: A machine of very low resistance.

Second: A machine of not more than 1½ pounds to the square foot, loading, and, of course, the lighter the better.

Third: Wings must shift fore and aft at will of pilot.

Fourth: A variable angle of incidence controlled by pilot.

Fifth: A variable angle of incidence in either wing independent of the other, controlled by the pilot.

Sixth: Ample elevating surface in conjunction with fore and aft shift of wings, controlled by pilot.

Seventh: Ample rudder surface.

Eighth: Ample lateral balancing surfaces.

These last three for safety if nothing else, although the lateral balance will be taken care of in a machine having the variable angle as mentioned in fifth item.

Ninth: A heavy top and bottom bird-like camber which dies out towards the wing tips and, if possible, a flexible trailing edge.

Tenth: Fore and aft shift of pilot's weight.

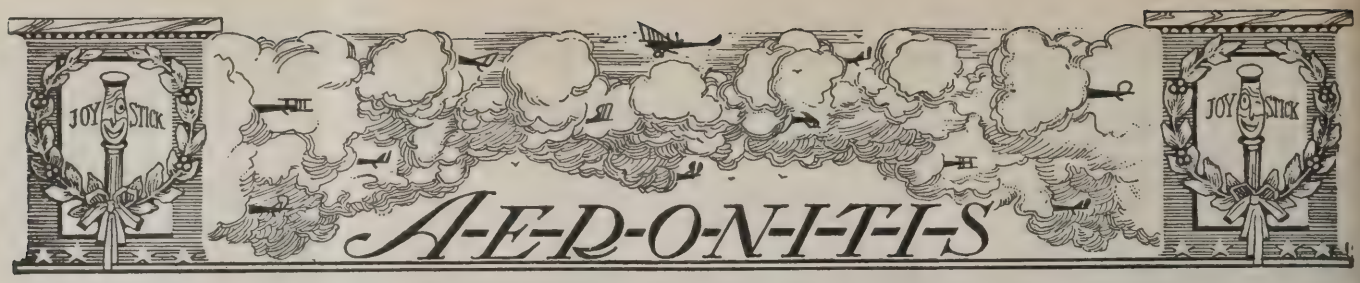
All the above seems to call for a great deal of complication, but I think a design is possible that will make all this very simple and with very few moving parts.

In 1914 I started the construction of a soaring plane which was to embody some of the above features, but had to defer it owing to the war.

A Light Aeroplane Club Proposed for Young Men of Cleveland

Believing that it is "up to someone to do something" to arouse the interest of the people in Cleveland in aeronautics, Mr. Edward T. Purchase, 1983 Moltke St., Cleveland, Ohio, proposes the organization of an "Aeroplanette" Club such as suggested in *Aerial Age* by Mr. C. S. Parker of New York City.

Mr. Purchase declares that aeroplanes and aeronautics in general would be helped if a group of young men in Cleveland got together and interested themselves in the development of motorcycle engine planes and Ford engine planes. He suggests the formation of a club beginning with about twenty members over 16 years of age, and anyone wishing to join is invited to write Mr. Purchase at his home, enclosing a stamped self-addressed envelope for reply. As he has already undertaken the construction of a small training aeroplane or "grass cutter" of his own design, and has several designs to suggest to prospective members, there is every assurance that those who join will have a good deal to interest them at the start and that an association of young enthusiasts such as proposed should attract favorable attention in the region of Cleveland.



The Brave Aviators

High up in the atmosphere,
They sail on wings without fear.
High up in the chilly air,
They take risks that do and dare.

* * *

The wide expanse is their home,
There they love on wings to roam.
The humming motor and whistling wind,
Is their music when voice is dinned.

* * *

They know that it is as safe
To fly as riding on a wave.
They know the dangers of air stunts
Are as flying in the teeth of guns.

* * *

Why do they then stunt you say!
They do so to blaze the way.
And show how safe flying is,
And clear away man's prejudice.

* * *

The world seems slow to take to wings,
So the brave Aviator thinks.
He'll show the world by doing stunts,
Knowing oft how the story runs.

* * *

And when one dies who's to blame?
It was to advance the game.
They take it like Gladiators,
One by One the Brave AVIATORS.

—*H. Theo. Haller, Los Angeles, Cal.*

The Wrong Setting

The candelabra glowed a glare
Upon her soft, elusive hair
And shone profound affection where.....
They sat.

The lad requested but one kiss
From the aforesaid little miss.
"Now don't refuse," he said, "for this.....
Or that."

"By these little lights above you
I adore you, little dove, you."
She replied, "I cannot love you.....
Here."

Damn Personal

By Seethat Jerdont

"When the frost is on the punkin,
And the corn is in the shock
The maids get out their lipsticks
And men redeem their tucks from hock."

—*Old Song.*

One on Collier

GEOLOGY PROF: Please give us the name of the largest diamond.

STUDE (the morning after the night before): The ace, doctor.—*Tar Baby.*

"I'll raise you two," said the wealthy lady to the orphans.

A Toast

Here's to the man who wears his hat,
And wears his hat alone,
For many a man wears another man's hat
And says he is wearing his own.

"Why did they put Bob out of the game?"
"For holding."
"Oh, isn't that just like Bob?"—*Virginia Reel.*

"My father occupied the chair of applied physics at Cambridge."

"Dat's nuttin'; mine occupied the seat of applied electricity at Sing Sing."—*Voo Doo.*

Ode to Ten Bucks

Oh, sweet, elusive ten-buck bill,
Pray bide with me awhile;
I'll let thee go against my will,
I love your golden smile.

"Best friends must part," the poets say,
"But parting brings sweet sorrow!"
I'll let you go tonight and pray
For more of you tomorow.—*Punch Bowl.*

Why Not?

His arm, it slipped around her waist—
Why shouldn't it?
Her head, it dropped against his breast—
Why shouldn't it?
Her heart, it gave a tender sigh—
Why shouldn't it?
Her hat pin stuck him in the eye—
Why shouldn't it?

—*Siren.*

"What is a pessimist?"

"He's a guy that complains because his bank roll is so thick that it breaks the stitches of his wallet."—*Punch Bowl.*

MOTHER: Share this apple with your sister, Willie. Show a Christian spirit.

WILLIE: Whadda yuh mean—a—Christian spirit?

MOTHER: Take a small bite yourself, and give Flossie the rest.

WILLIE: After you, Floss.—*Allt for Alla* (Stockholm).

Our Text-Book Age

"If I only knew what to do with baby!"

"Didn't you get a book of instruction with it, mother?"—*Kaper* (Stockholm).

Three Up—One to Go

"I hardly know how to decide this case."

"Well, Judge, there are two sides to every question."

"This is a triangle."—*Louisville Courier-Journal.*

VOICE OVER 'PHONE: I can't sleep, doctor. Can you do anything for me?

DOCTOR: Hold the wire and I'll sing you a lullaby!—*Passing Show* (London).

At Last

BURGLARS One sound from you and I'll squeeze you to death!"

ANTIQUE MAID: "Remember, that's a promise."

—*Washington Sun Doager.*

A Kind Boss

PILOT: "I'd like to get marired but I can't support a wife on my present salary."

KIND BOSS: "All right, my boy, I'll give you a raise. But don't say afterwards that I did you no favor."—*Louisville Courier-Journal.*

The rookie stood on the railroad track—
The engine gave a squeal;
The fireman stepped down from the cab
And scraped him from the wheel.—*Idaho Yarn.*

AERIAL AGE WEEKLY

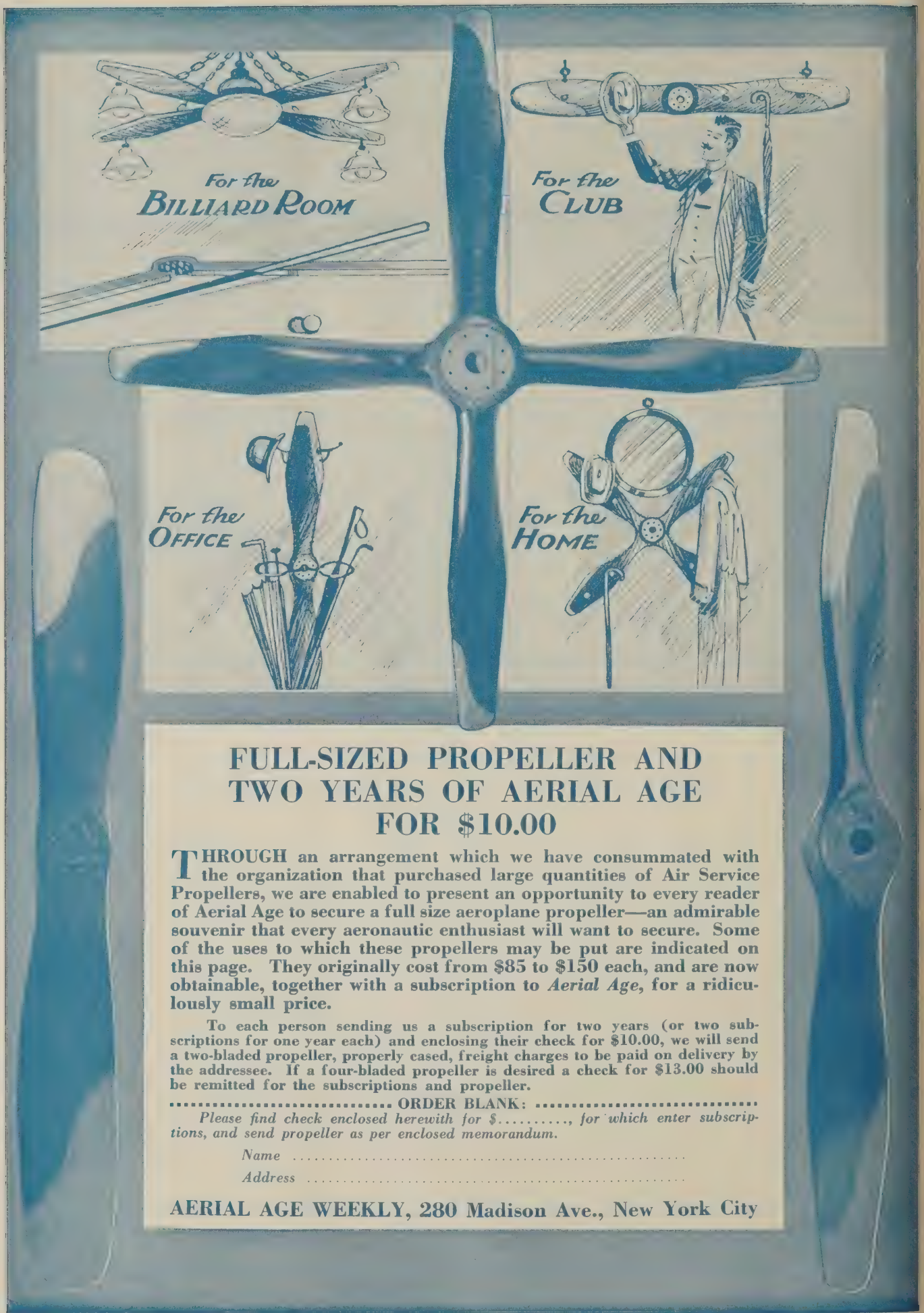
L. 14. No. 16 DECEMBER 26, 1921 10 CENTS A COPY



Airscape of the Thirty-Fourth Street District, New York. Photographed by the Fairchild Aerial Camera Corp.

The Need for An Aeronautic Chamber of Commerce — Naval Aviation Progress — Eighteen Years of Wings

SHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
iptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



FULL-SIZED PROPELLER AND TWO YEARS OF AERIAL AGE FOR $10.00

THROUGH an arrangement which we have consummated with the organization that purchased large quantities of Air Service Propellers, we are enabled to present an opportunity to every reader of Aerial Age to secure a full size aeroplane propeller—an admirable souvenir that every aeronautic enthusiast will want to secure. Some of the uses to which these propellers may be put are indicated on this page. They originally cost from $85 to $150 each, and are now obtainable, together with a subscription to *Aerial Age*, for a ridiculously small price.

To each person sending us a subscription for two years (or two subscriptions for one year each) and enclosing their check for $10.00, we will send a two-bladed propeller, properly cased, freight charges to be paid on delivery by the addressee. If a four-bladed propeller is desired a check for $13.00 should be remitted for the subscriptions and propeller.

ORDER BLANK:

Please find check enclosed herewith for $....., for which enter subscriptions, and send propeller as per enclosed memorandum.

Name .....

Address .....

AERIAL AGE WEEKLY, 280 Madison Ave., New York City

December 26, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 16

TABLE OF CONTENTS

The Need of an Aeronautic Chamber of Commerce 363
Naval Aviation Progress 363
Eighteen Years of Wings..... 363
The News of the Week..... 364
Calendar of Coming Events..... 364
The Aircraft Trade Review..... 365
Bills Introduced in Senate and House to Aid Development of Civil Aviation 366
Naval Aviation Activities in 1921.. 367
Ground Influence on Aerofoils..... 369
Landing Fields in Canada..... 371
Aeronautic Roads—Block System.. 373
The Work of the Forest Products Laboratory 374
Naval and Military Aeronautics... 375
Foreign News 376
Elementary Aeronautics and Model Notes 377
Aeronitis 378

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

This Pilot says:
"I have flown the Lincoln Standard over four States and consider it the best ship on the market. Its ability in tight places is wonderful."

Price $3985
F. O. B. Factory

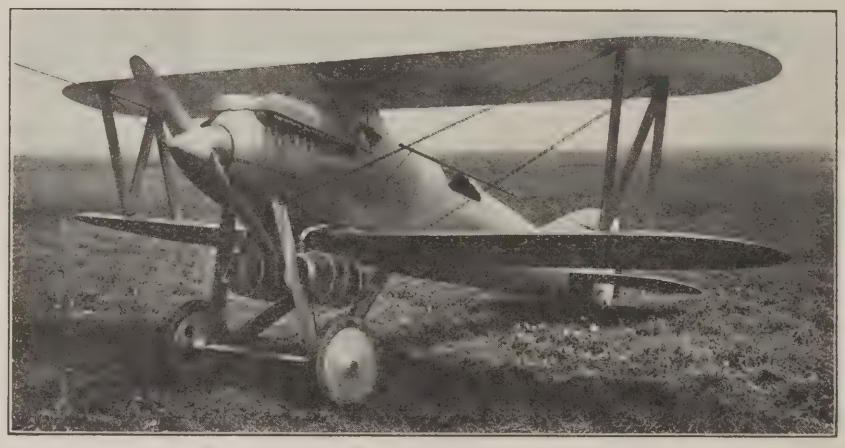


Ted LeCocq, Pilot (at left)
D. Swanson, Mechanic
Flying Lincoln Standard Speedster

"Man-O-War"
Owned by Mr. Collins of
Collins Oil Co., Knoxville, Ia.

NEBRASKA AIRCRAFT CORP.
Lincoln, Nebraska

Curtiss



WORLD'S RECORD

"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

CURTISS AEROPLANE & MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of
Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., December 26, 1921

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, DECEMBER 26, 1921 No. 16

The Need for an Aeronautic Chamber of Commerce

ELSEWHERE in this issue we publish in full the bill introduced simultaneously in the Senate and House by Senator Wadsworth and Congressman Hicks, which indicates that at last a definite and concerted movement has been started to give the United States something like a national policy so far as civil aeronautics is concerned. In order that we may be in a position to accept all the benefits that come when this Bill is enacted into law, it behooves the aeronautic industry to get its house in order for the new regime, and the important ground work in this direction can best be done through an efficient Aeronautic Chamber of Commerce. In such a Chamber, including in its membership every aeronautic company in America, the Commissioner of Civilian Aeronautics would have a completely representative body to deal with, and this in turn would eliminate all log-rolling and delay, and would in the shortest time possible make available to the entire country all the benefits that will come from the proposed Bureau of Civil Aviation in the Department of Commerce.

Naval Aviation Progress

THE report of Admiral Moffatt, Chief of the Bureau of Aeronautics of the Navy, shows commendable progress for the past year in this branch of the nation's defenses. Perhaps the most outstanding fact in the report is the statement that naval and marine aircraft flew, during the fiscal year, a total of 2,511,055 miles. The notable flights of the year were those of the Atlantic and Pacific fleet air forces to the Panama Canal and return, the F-5L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia, and the Marine Corps' flight from Washington, D. C. to Santo Domingo City and return.

The question of developing a means for launching planes from battleships has apparently been successfully solved, and it will now be possible to provide all ships of the fleet with fighting planes as an answer to the menace of bombing aircraft.

The helium plant at Fort Worth, Texas has been placed on a production basis, and recently we referred to the success of the flight of the dirigible C-7, inflated with this gas.

Progress has been made in the photographic department, and during the year a photographic map of the Mississippi Delta was prepared for the Coast and Geodetic Survey and a map of Guantanamo Bay for the Hydrographic Office.

Excellent progress has also been made in the communication by wireless between aircraft and surface vessels.

Altogether the report of the Bureau of Aeronautics is most encouraging.

Eighteen Years of Wings

THE world of the late eighteen-nineties would have read with amused skepticism a prophecy that any such statement as Orville Wright issued yesterday would appear in December, 1921. The statement has appeared, and the world is not particularly excited. It is likely to forget in the moment of achievement, the stupendous nature of what has been achieved.

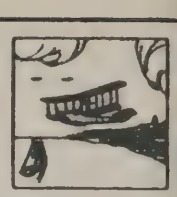
Yet there can be no doubt, to-day, eighteen years after the first flight in a heavier-than air machine, that the world has gone beyond most of its early dreams of human power to soar. The magic carpet of the Arabian Nights, the roc, Venus's sparrows, and Daedalus's wings are crude instrumentalities beside the N. C.'s, the ten passenger flying boats that ply between Key West and Havana, or the Curtiss navy racer that recently flew hundreds of miles at a league a minute. Venus and Icarus flew precariously through the open air, exposed to wind and sun. The modern passenger sits in a limousine interior and scans his paper, dozes, or contemplates the fading earth through windows.

We are less appreciative of what we have achieved because in achievement it has been dissociated from dreams and become associated with work and dollars. Tennyson's prophecy of the flyer harrying his enemy or "dropping down with costly bales" has proved a literal one. We carry the mail by air from New York to San Francisco, and we go faster than the fastest known winds, but we talk of pressure feed systems, fireproof dopes, super-charges, and stream-line fuselages instead of magic pinions and purple twilights. Flying is coming in like a lion—that is to say, like a standardized high-powered automobile or a Twentieth Century locomotive.

It was bound to be so, and it will be more so in the future. We need not be the less appreciative of flying on that account. What the world has never seems as wonderful as what it wanted, but a candid inventory of advantages usually proves that it is. If we do not get from the steamship, the railroad and the aeroplane all we dreamed of much of the fault lies with us. The machines do more than we asked. The disappointment and disillusion, where they exist, can too often be traced to our use of them.—*Editorial in N. Y. Globe.*



THE NEWS OF THE WEEK



Curtiss Wins Suit

The claim advanced by Glenn H. Curtiss that he he was the first to build a flying machine that could rise from and alight on the water, in seeking to establish his right to a broad patent on the hydro-aeroplane, was upheld December 15 in a decision by the United States Circuit Court of Appeals of the Second District, and which reverses the decision of the United States District Court of the Eastern District of New York in the case of the Curtiss Aeroplane and Motor Corporation and Glenn H. Curtiss against Albert S. Janin and the Janin Company, Inc. The decision, signed by Judge Charles M. Hough, Martin T. Manton and Julius M. Mayer, constitutes the final chapter, at least in this jurisdiction, of one of the longest legal controversies ever waged in this country over the development of flying machines. At the offices of the Curtiss Company it was explained that the decision could not be appealed in this judicial district.

The prolonged legal controversy grew out of an application for a patent filed on Aug. 22, 1911, by Mr. Curtiss who, on Jan. 26 preceding, had demonstrated his flying boat in the harbor of San Diego, Cal. His successful flight with an air machine equipped with a boat hull structure and wings buoyed with small pontoons was made on the same day that Janin filed his application for what he described as a land, water and air machine.

The opinion of the court, written by Judge Hough, holds that when Curtiss made the San Diego flight he then succeeded in reducing to practice the theory of his invention, which entitled him to the broad patent thereon inasmuch as Janin's invention, at the time of this flight, and even later when the application of Curtiss was filed, had not advanced beyond the theoretical stage where it was described on paper, and that the mere description did not constitute a reduction to practice since it was never proved, and was unlikely to be proved, that Janin's plans would enable another person to build a hydro-aeroplane that would work with success.

"In this case," reads the opinion, "we feel sure that defendant's constructive reduction to practice received no assistance from any previous conception on his part; and this is true even if full credence be given to defendant's evidence as to his early drawings, models and experiments and no weight be attached to plaintiff's testimony tending to show Janin as one unworthy of belief.

"The reason for this holding is that whatever Janin conceived prior to Jan. 26th, 1911, whatever experiments or models he made, it is admitted that the ripe fruit of all that he had done was contained in the specification he then filed. If, therefore, that specification does not enable the man skilled in the art to construct without further exercise of the inventive faculty an operative hydro-aeroplane there has been no reduction to practice, constructive or otherwise.

"Janin disclosed no boat body, by his own evidence he never conceived a boat body other than one like that of a swift small vessel (e. g., a torpedo boat). He speaks even in his 1913 specifications only of a 'hull-like body,' and his drawings only reveal the freeboard of something long and narrow of historic boat shape."

The San Diego flight made by the Curtiss hydro-aeroplane was made possible by his development of the boat body with wing pontoons at his plant at Hammondsport, N. Y., where he was working on the water machine as early as 1910, when he flew from Albany down the Hudson to Governor's Island, alighting on land with an aircraft equipped with the floating appurtenances to alight in the river. The flight down the Hudson was witnessed by thousands along Riverside Drive and from the office buildings affording a view of the waterfront.

A technical discussion of the Court decision will be presented in the next issue of AERIAL AGE.

Gen. Mitchell to Fly 4,000 Miles in Europe

Brig.-Gen. William Mitchell, assistant chief of the air service of the army, left New York recently for a journey of 4,000 miles in Europe, most of which he expects to cover by aeroplane. The General was at the Aero Club of America and, according to Maurice Cleary, a governor of the club, he has been directed by the War Department to investigate and report on the development of military and commercial aviation in France, Holand, Germany and Italy.

Mr. Cleary said we had much to learn from European countries, and it was understood that Gen. Mitchell expected to collect information about the designs and construction of new types of machines and the organization and operation of commercial lines.

Contenders for the Collier Trophy

Contenders for the Collier Trophy should present their claims in writing to the "Collier Trophy Committee, Aero Club of America, 11 E. 38th St., New York City," before Saturday, January 7, 1922, as the award of this Trophy will be announced at the 14th Annual Banquet of the Aero Club of America, January 9, 1922.

This bronze trophy, to be known as the "Aero Club of America Trophy," was presented by Robert J. Collier, Esq. The trophy is to be awarded annually for the greatest achievement in aviation in America, the value of which has been thoroughly demonstrated by use during the preceding year.

The first award was given to Glenn H. Curtiss for his development and demonstration of the hydroaeroplane during the year 1911.

The trophy for the year was again awarded to Glenn H. Curtiss for his development and thorough demonstration of the flying boat, in which buoyance is supplied by the fuselage.

In 1913 the trophy was awarded to Orville Wright in recognition of the development and demonstration of his automatic stabilizer.

For 1914 the trophy was awarded to Mr. Elmer A. Sperry for his work in achieving the automatic control of an aeroplane by means of the gyroscope.

The trophy for the year 1915 was awarded to Mr. W. Starling Burgess, of Marblehead, Mass., in recognition of his development and demonstration of the Burgess-Dunne hydroaeroplane during the year 1915.

The trophy for 1916 was awarded to Mr. Elmer A. Sperry for the development and thorough demonstration of the Sperry Drift Set.

CALENDAR OF COMING EVENTS
under saction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.



U. S. Liberty 4 Engine

Spokane.—A new aerial motor, known as the "U. S. Liberty 4," has been designed, built and developed in Spokane by officials of the United States Aircraft Corporation, according to C. H. Messer, president of the concern. The engine has been given 50 hours in the air under difficult flying conditions, and is claimed to be an improvement over other types of engines in use here.

Through the engineering force of the aircraft company, the weight of the motor has been reduced from 595 to 414 pounds, a difference of 180 pounds, and the speed of the motor has been increased from 1400 revolutions a minute to 1600.

Additional reliability has been given by changing from the high to low compression type of motor.

In the tests of the new motor it has been found that the gasoline consumption has been decreased from 10 gallons to 8 gallons per hour, and the oil consumption cut from four quarts to one and a half quarts per hour, Mr. Messer said.

"The new motor which we have developed and designed has many advantages over anything we have used previously," Mr. Messer said. "It is so much lighter that we are enabled to carry an additional passenger with perfect safety. Although before the change the four-cylinder motor would deliver but 100 horsepower, we now compute its power at 140 horsepower.

"This motor has been especially designed to meet the needs of the western country. The propeller has greater ground clearance, making landings in rough country more easily accomplished. The nose of the machine is lighter, and the machine climbs much more rapidly.

"The low compressor type, with higher speed, makes the motor especially adapted to crossing the mountains, as it functions equally well at high or low altitudes. It greatly increases the speed of our Standard JI ships.

"Lieutenant Mamer, chief pilot, has made a trip to Montana and returned with the U. S. motor, and climbed it as high as 12,000 feet to cross the mountains, and found it to function perfectly.

"We intend to equip our three ships with the motor as fast as additional ones can be built. We will then look into the market to determine the advisability of constructing more of them for others who desire them."

Echo of the Pulitzer Race

We are in receipt of the following letter from C. Roy Keys, manager of the Curtiss Aeroplane and Motor Corporation, which is self-explanatory.

"In one of your contemporaries, *The Aeroplane*, of London, as quoted in the Air Service News Letter of December 9, 1921, the editor made the following comment on Acosta's performance in the Racer: (This is copied exactly as the Air Service News Letter printed it).

"At first his speed was given as under 173 m. p. h. but as this was not a world's record it was no good to America, whose representatives remeasured the course a little longer which brought up the speed to the required figure. According to one American newspaper the Curtiss Navy Racer was fitted with O.C.D. 12,400 h.p. motor and crossed the starting line at more than 250 m.p.h. This seems a very fair and modest estimate for such a powerful 'airplane'."

"In the first place, Mr. Grey, the editor of *The Aeroplane*, always has been an unconstructive criticizer of everything that happens over here, and here plays upon the efficiency of some newspaper's typesetting department in making his caustic remark; also you know and we know that the measuring of the course at Omaha was done by members of the committee there, through, I presume, civil engineers. If some publications said that it was surveyed at the instigation of Curtiss officials, as they did, it was because of numerous facts—one of them being that at least thirty days prior to the meet, the writer had a conference with the Secretary of the Aero Club of Omaha, in which he discussed numerous things, among others the direction around the pylons that the race ought to be run and the fact that the course should be carefully surveyed, with some knowledge of the 1920 development in his mind; also that Mr. Bradley, of the Manufacturers Aircraft Association, who went to Omaha six or seven days before the race, was asked by the writer and by Mr. Russell to be sure that the Aero Club of Omaha had had the course surveyed and proper certificates from competent engineers as to its length. When the reports began to come in of the speed of 176.7 miles per hour, every newspaper practically that talked to the writer, asked if the course had been surveyed, and we were able to state that we had been advised very definitely that the course was surveyed, and finally, of course, were able to tell them the exact length of the course."

Instrument Guides Planes in Fog

Fog is the airman's most dangerous foe, says the London *Times*. The pilot flying in cloud or fog, when he can see neither land nor sky, has no actual consciousness of direction, nor is he able to gauge the poise of his machine. True, he has a compass on board, but the lateral movement and the banking, the changes from climb to descent and vice versa, are inimical to the accurate reading of a compass. The compass card, continually disturbed by these movements, swings backward and forward, with no consideration for the magnetic north or anything else. Sooner or later the pilot is being carried by the aeroplane he knows not where. This fact has never been better illustrated than when recently a flight of machines set out from Shotwick for Dublin, a distance of only 120 miles. Heavy fog and cloud were met. One of the airmen came down off the Scilly Isles. The remainder were never found.

A device to keep the pilot constantly informed in cloud and fog of the actual behavior of his machine has just been perfected. It is called the Reid control indicator. It analyses, by means of a series of small electric lights, every tendency and movement of the aeroplane to which it is attached. It tells the pilot the air speed of his machine, its rate of turn when turning, and whether the machine is correctly banked for its rate of turn, and also direction of sideslip. It demonstrates, moreover, the movement necessary to enable the pilot to regain lost equilibrium and maintain a straight course.

The instrument weighs rather less than four pounds. It is divided into three parts, an upper row of lamps controlled by a mercury device, a lower row controlled by a gyroscope, and an air speed indicator. If the airplane is turning the lamps in the lower row light up, beginning from the centre and working outward, and so indicating the direction of the turn. If the machine is sideslipping lighting is produced on the same principle in the upper row. The port or left hand lamps are red, the starboard or right are green. The centre lamp in both rows is white. If the two white lights remain constant the machine is on a straight course.

The air speed indicator is set in the centre of the instrument and between the rows of lamps. From it the pilot can tell whether he is climbing or descending, according to whether his speed decreases or increases.

The rotation of the gyroscope is effected by an air stream created by the flight of the aeroplane, impinging on the gyro-wheel, in which slots are cut. Under this air pressure the wheel spins at a rate of 6,000 revolutions a minute. The wheel seeks to maintain itself on a constant axis; in other words, gyroscopic action holds it in one vertical plane, and if the aeroplane turns out of that plane to right or left the wheel fights to maintain its position and automatically closes a series of electrical switches on one side or the other and the corresponding lamps in the bottom row on the indicator are lit, as explained above. The number so lit corresponds with the amount of the aeroplane's turning movement.

A mercury bubble device controls the lamps in the upper row, illuminating or extinguishing them according to the movements of the aeroplane out of and into the horizontal plane.

It is claimed that with the Reid control indicator there is no evolution that cannot be carried out by an airman in fog and cloud, and that it makes point to point flying entirely simple in thick weather.

Personal Par

Foster Russell, of the Foster Russell Aeroplane Company, Spokane, Washington, who is in the east looking over the latest types of commercial aircraft, recently flew in the Sport Farman from Philadelphia to Baltimore to attend the flying meet of the Baltimore Flying Club. Mr. Russell was very much pleased with his trip and also with the many types of new machines which were exhibited at Baltimore.

BILLS INTRODUCED IN SENATE AND HOUSE TO AID DEVELOPMENT OF CIVIL AVIATION

AS we briefly reported last week Senator Underwood and Congressman Hicks have introduced identical bills to create a Bureau of Civil Aviation in the Department of Commerce, for the regulation and development of air navigation. This action concurs with the recommendations of the President contained in his special message on the subject of aviation, sent to Congress since the opening of the present session in transmitting the annual report of the National Advisory Committee for Aeronautics.

These bills as introduced have been perfected and agreed upon by all agencies directly concerned with aeronautics, and hearings are expected to be held at an early date. The measures provide for the appointment by the President of a Commissioner of Civil Aviation, who shall prepare rules and regulations for air navigation, including the issuance of licenses for aircraft, aviators, and air stations, and authorizes him to designate and lay out air routes and to study the possibilities for the development of civil aviation in all parts of the United States.

The bill in its present form is the result of conferences between the representatives of the Aero Club of America, the aircraft industry, and heads of the Army and Navy Air Services, the Weather Bureau, and the National Advisory Committee for Aeronautics, and it is understood that it will have the support of the Administration leaders in Congress.

Following is the bill introduced by Congressman Hicks on Dec. 9:

A Bill

To create a Bureau of Civil Aviation in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That there is hereby established in the Department of Commerce, under the jurisdiction of the Secretary thereof, a bureau to be known as Bureau of Civil Aviation.

SEC. 2. That a Commissioner of Civil Aviation shall be at the head of such bureau, who shall be appointed by the President, by and with the advice and consent of the Senate, who shall receive a salary of $7,500 per annum. There shall also be an assistant commissioner of such bureau, who likewise shall be appointed by the President, by and with the advice and consent of the Senate, who shall receive a salary of $5,000 per annum. The assistant commissioner shall perform such duties as may be prescribed by the commissioner or as may be required by law. There shall be also a chief clerk of said bureau and such other deputies, assistants, and employees as may be required from time to time and as may be authorized by law.

SEC. 3. That it shall be the duty of the Commissioner of Civil Aviation, in conformity with the provisions of this Act, to foster civil aviation in every way possible and to do all things necessary therefor, co-operating with all other established governmental agencies and taking advantage to the fullest degree possible of the facilities they can offer. This shall include the following duties:

(a) To inspect the design and construction and, if approved, to license the operation of civil aircraft, in order to safeguard life and property.

(b) To regulate the navigation and operation of civil aircraft through the establishment of aerial traffic rules and regulations, in order to safeguard life and property.

(c) To designate, approve, and lay out air routes.

(d) To establish and encourage the establishment of landing fields and air stations.

(e) To make recommendations to the Weather Bureau as to the necessary meteorological service.

(f) To study the possibilities for the development of civil aviation in the United States, and to collect and disseminate information in relation thereto.

(g) To investigate, record, and make public the causes of accidents in civil aviation.

(h) To exchange with foreign Governments, through existing commercial attachés, information pertaining to civil aviation.

(i) To operate such aircraft as the Secretary of Commerce may deem necessary, licensing, regulating, and controlling the operation of civil aircraft, and the establishment of air routes, landing fields, and air stations.

(j) To prescribe the manner of using air routes and to utilize air navigation facilities and appurtenances.

(k) To prepare and maintain a comprehensive survey and inventory of all industrial and civil aeronautical resources under the jurisdiction of the United States.

SEC. 4. That, subject to the approval of the Secretary of Commerce, and for the purpose of making effective the provisions of this Act, the Commissioner of Civil Aviation shall by regulation provide for—

(a) Licensing pilots and such other persons engaged in the navigation or operation of civil aircraft as may be required for the public safety, and upon good cause the suspension or provocation of such licenses.

(b) The registration, identification, inspection, certification, or licensing of all civil aircraft, and upon good cause the suspension or revocation of such licenses.

(c) The registration, identification, inspection, certification, or licensinng of all civil landing fields or air stations, and upon good cause the suspension or revocation of such licenses.

(d) The conditions under which civil aircraft may be used for carrying and transporting persons or property or for the operation of any civil aerial service whatsoever and the licensing of any such service.

(e) The prohibition of the navigation of civil aircraft over such areas as may be specified for military, naval, postal, or other purposes, either temporarily or permanently, and either absolutely or subject to such exemptions or conditions as may be prescribed.

SEC. 5. That all rules and regulations authorized under the provisions of this Act shall be formulated by the Commissioner of Civil Aviation in cooperation with other established governmental agencies concerned, and they shall then be recommended to the Secretary of Commerce, and upon the latter's approval such rules and regulations shall be promulgated by him and shall have the effect of law and be enforceable from the date of such promulgation unless otherwise provided therein. The Secretary of Commerce, upon similar recommendations, shall have the power to amend, alter, suspend, or revoke such rules and recommendations and to promulgate new rules and regulations from time to time.

SEC. 6. That, subject to the approval of the Secretary of Commerce, the Commissioner of Civil Aviation shall, with the concurrence of other departments of the Government concerned, establish the conditions under which persons may be carried and property imported and exported in civil aircraft from, into, or through the United States, its Territories and dependencies, and to prescribe the areas within which aircraft entering the United States, its Territories, and dependencies or the waters thereof, are to alight and the conditions to be complied with by such aircraft.

SEC. 7. That the word "aircraft" as employed in this Act shall embrace every type of flying machine, conveyance, or vehicle now known or hereafter invented, devised, or developed, whether or not used in the carriage or transportation of persons or property, or without persons or property, flown, operated, or navigated in or through the air, and that the term "civil aircraft" as employed in this Act shall embrace all forms of aircraft except those owned and operated by the Army and the Navy.

SEC. 8. That it shall be unlawful to fly or to navigate or operate any civil aircraft in violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, or to fly or to navigate or operate any civil aircraft in interstate or foreign commerce, or in, over, upon, or along or through navigable streams, rivers, or waters, or post roads or routes of the United States, or the air or atmosphere above the same, or in, over or through the District of Columbia, the Territories, dependencies, reservations, national parks, or over any place or building over which the United States has jurisdiction, or to maintain or operate any landing field or air station over which the Bureau of Civil Aviation may exercise jurisdiction except in conformity with the provisions of this Act and such rules and regulations as may be promulgated pursuant thereto.

SEC. 9. That any violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, shall be punishable by a fine not exceeding $1,000 or by imprisonment for a term not exceeding one year, or both.

SEC. 10. That the Commissioner of Civil Aviation and such deputies as he may designate shall have power to conduct hearings, to subpoena witnesses, send for documents and other papers, to administer oaths, and to take such testimony

as may be necessary in determining the qualifications of individuals for licenses or registration certificates to operate aircraft, landing fields, or air stations, or in the suspension or revocation of such licenses or registration certificates, or to enable him or them to make effective any of the provisions of this Act or any rule or regulation promulgated in conformity therewith.

SEC. 11. That the Commissioner of Civil Aviation is authorized, subject to the approval of the Secretary of Commerce, to fix the fees and charges for such inspection, registration, and licensing authorized by this Act, which fees and charges shall be collected by the Commissioner of Civil Aviation and put into the Treasury of the United States to the credit of miscellaneous receipts.

SEC. 12. That for the purpose of encouraging the development of civil aviation in he United States, full cooperation shall be given by the Bureau of Civil Aviation to the owners or operators of civil aircraft, and that the Secretary of War, the Secretary of the Navy, the Secretary of the Treasury, the Postmaster General, and the Secretary of Commerce shall furnish to any owner or operator of civil aircraft landing on an air station or landing field under their respective jurisdictions aviation fuel, oil, supplies, and necessary machanical assistance of an emergency character, under such regulations as they may approve and promulgate for their respective services. The proceeds from such sales and assistance shall be deposited in the Treasury of the United States to the credit of the appropriations involved.

SEC. 13. That the Commissioner of Civil Aviation shall publish periodically a bulletin setting forth all licenses issued or revoked, together with field reports of all flying activities, accidents, and field and route data, under the control of the bureau.

SEC. 14. That the Commissioner of Civil Aviation shall annually, at the close of each fiscal year, make a report to the Secretary of Commerce, giving an account of all moneys received and disbursed by him and describing the work done by the bureau, and the Secretary of Commerce shall transmit such report to Congress with the annual report of the Department of Commerce.

SEC. 15. That the district courts of the United States shall have exclusive jurisdiction over all claims and controversies involving aircraft, landing fields, and air stations, their owners, lessees, charterers, and operators licensed hereunder, with the right of appeal as in other cases. The law and procedure to be applied in determining such claims or controversies wherever arising, whether on land, water, or in the air, shall conform as nearly as may be to the principles of law and procedure applied in cases of admiralty jurisdiction. The owners, lessees, charterers, and operators of such civil aircraft, landing fields, and air stations shall be entitled to the same measures of exoneration from the limitation of liability as are provided for the owners, lessees, charterers, and operators of vessels by section 4281 to 4286, both inclusive, of the Revised Statutes of the United States, section 18 of chapter 121 of the Act of Congress of June 26, 1884, and the Acts amendatory thereof and supplemental thereto; and the rules of the Supreme Court of the United States and of the inferior United States courts relating to limitation of vessel owner's liability as now in force or as may be hereafter promulgated shall be applicable to claims and controversies involving such aircraft, landing fields, and air stations, their owners, lessees, charterers, and operators.

SEC. 16. That all salaries provided herein and all expenses incurred under the provision of this Act shall be paid out of such money as may be appropriated therefor by Congress.

SEC. 17. That if any portion of this Act be declared invalid it shall not affect any of the other portions thereof, which other portions shall continue in full force and effect.

SEC. 18. That this act shall take effect from and after the date of its passage, and all Acts or parts of Acts inconsistent herewith are hereby repealed.

NAVAL AVIATION ACTIVITIES IN 1921

FOLLOWING are extracts from the annual report of the Chief of the Bureau of Aeronoutics of the Navy.

Naval aviation activities during the fiscal ended June 30, 1921, continued to be scattered throughout various offices of the different bureaus of the Navy Department. With the lack of a coordinating central office to handle aeronautical matters, conditions were especially trying in the endeavor to promote naval aviation. This condition continued until September 1, 1921, when the Bureau of Aeronautics was established in the Navy Department. Notwithstanding the trying conditions that have existed during the past year, progress has been made both in the development of types of planes and in general aeronautical research work. Some of the outstanding features of the year's work cover the following:

(a) Flights of the Atlantic and Pacific Fleet air forces to the Panama Canal and their return.

(b) The flight of F-5-L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia.

(c) Marine Corps flight from Washington, D. C., to Santo Domingo City and return.

(d) Bombing experiments conducted on the ex-battleships Indiana and Iowa, and on ex-German warships.

(e) Practical completion of the large rigid airship shed at Lakehurst, N. J., and advancement in the construction of the rigid airship ZR-1 at the naval aircraft factory.

(f) The completion of a competition for the design of planes suitable for use from battleships.

(g) The continued progress in fitting the U. S. S. Langley as an aircraft carrier.

(h) The practical completion of the U. S. S. Wright as a lighter and heavier than air tender for aircraft with the fleets.

(i) Mileage flown by naval and marine aircraft for fiscal year, 2,511,055 miles.

The value of naval aircraft to the fleets has been demonstrated in spotting gunfire, in scouting, and in bombing.

Last year radio communication between aircraft and surface vessels was very elementary. Development has been made during the past year so that it is now possible for an aeroplane to be in direct aero radio communication with land stations and surface craft for considerable distances and under adverse weather conditions.

Heavier-than-Air

The accomplishments of the fleet air forces have been particularly gratifying. Nine F-5-L flying boats of the Atlantic Fleet air force made the trip from Philadelphia to the Canal Zone and return. Twelve F-5-L flying boats of the Pacific Fleet air force flew from San Diego to the Canala Zone and return. The actual distance covered in the flights of these two detachments approximate 12,000 miles.

Other flights of note during the past year were those of two DH-4B aeroplanes by the Marine Corps, from Washington, D. C., to Santo Domingo City and return, and the flight of F-5-L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia. The marine flight covered a distance of approximately 5,400 miles and the flight from Coco Solo a distance of about 800 miles.

In addition to the torpedo instruction that has been given at Pensacola, Fla., and the training flights and firing of dummy torpedoes at San Diego, the Atlantic Fleet torpedo division has operated from Yorktown, Va., as a base, and has conducted experimental research work in firing actual as well as dummy torpedoes.

The air forces of each fleet are now composed of scouting, spotting, combat, torpedo and bombing, and kite balloon squadrons.

As a result of competition among the aircraft manufacturers of the United States a type of plane suitable for spotting work is being developed, the award having been made to the winner of this competition, the Dayton Wright Co., and they are now engaged in producing the first planes of this type. To date none have been delivered.

It was arranged by the Army and Navy to loan to contractors planes which had been built by them for the Pulitzer race for the purpose of entering them in the contractor's name and at his risk and expense. The race this year was won by a Navy plane loaned to a contractor in this manner, fitted with a 400-horsepower engine and showed a higher speed than the 600-horsepower plane which won the last year's race. This indicates very satisfactory progress in aeronautical design in the past year. The reliability of the planes taking part in the race was better than the year before but still leaves room for improvement.

The question of developing a means for launching planes from battleships while under way or at anchor, which would do away with the objections to the platforms now installed on the guns, has been undertaken and further development of the catapult, as originally suggested by Capt. W. I. Chambers, United States Navy, is in progress and appears to offer a solution to many of the difficulties encountered with the turret platforms.

The past year witnessed the successful completion of the new catapult design for launching aeroplanes or seaplanes from ships of the fleet. This catapult was a development of the catapult that was installed on the North Carolina class of vessels before the war, but has been refined and simplified and reduced to a small track rotating on a turntable base. Successful flights have been made with this catapult using standard service seaplanes.

The significance of the catapult development lies in the fact that it is now possible to provide ships of the fleet with fighting aeroplanes as an answer to the menace of bombing aircraft. The best defense from aerial bombs is considered to be the small fighting aeroplane which can be shot into the air at a moment's notice from a ship's catapult and sent aloft to shoot down the attacking bombers which will be necessarily slow and cumbersome weight carriers, and, as such, extremely vulnerable to attack by planes of the combat type.

Lighter-Than-Air

As a result of successful experiments carried out abroad in mooring rigid airships to a mast, such a mast has been erected at Lakehurst, N. J. The success of the mooring mast will facilitate practically and economically the handling and operation of airships and increase their field of usefulness, as the weather limitations attendant upon operation from sheds and the expense connected with the construction of these large sheds will be for the most part eliminated.

Exercises with kite balloons in the Atlantic and Pacific Fleets have been continued with a view to determining their usefulness and the methods of their employment in the fleet. A total of 1,253 flights have been made.

The helium plant at Fort Worth, Texas, has been placed on a production basis, and progress is being made in the development of the helium. A nonrigid airship of the C class is being inflated with helium at the naval air station, Hampton Roads, and a practical demonstration of the use of this gas will shortly be made. This will be the first airship that has ever operated with an inert gas.

Spotting and Control of Gunfire

Spotting and control of gunfire by aircraft has been continued in both the Atlantic and Pacific Fleets. In the Atlantic Fleet the spotting has been carried on from the F-5-L type flying boats and in the Pacific from the smaller ship-plane type of planes. Considerable progress has been made in this work, and the results obtained have been very satisfactory.

Photography

Two projects of a large nature during the year have been undertaken, namely, the construction of a photographic map of the Mississippi Delta, for the Coast and Geodetic Survey, and the photographic mapping of the naval reservation at Guantanamo Bay for the Hydrographic Office. Experimental work in connection with the rapid development of photographs, the actual development of photographs in planes, accurate and a standardized system of photographic mapping, have been undertaken with success.

The use of aerial photography in determining the results of gunfire has been undertaken and found of great assistance to the office of gunnery exercises in determining accurately the results of gunfire in target practice.

Eerology

Mutual arrangements for a systematic interchange of weather reports have been made between the Navy and the Weather Bureau. A service has been inaugurated in cooperation with the Weather Bureau and Naval Communications for broadcasting a special report for aviation and marine stations from Arlington, which covers the east coast of the United States and adjacent marine areas. A similar service has been agreed upon and is in the progress of preparation to cover the west coast, and also one to cover the Gulf of Mexico and central area of the United States.

Arrangements have been made permitting naval radio stations to transmit to neighboring naval air stations direct and to the Weather Bureau the weather reports received from ships at sea. Arrangements have also been made at Coco Solo to have ships entering and leaving the Canal Zone send back weather reports while within radio communication. Steps have been taken to arrange for a world meteorological broadcasting system by radio, but to date these have not been acted upon by the international communication conference.

Air Stations

A minimum number of air stations necessary for the proper training of personnel and operation of aircraft with the fleets has been maintained throughout the year. The following stations have been in operation: San Diego, Cal.; Hampton Roads, Va.; Anacostia, D. C.; Pensacola, Fla.; Lakehurst, N. J; Rockaway, Long Island. Outside the continental United States: Coco Solo, Canal Zone; Pearl Harbor, Hawaii. Stations under the Marine Corps: Quantico, Va.; Parris Island, S. C.; Port au Prince, Haiti; Santo Domingo, Dominican Republic, and Guam.

In the interests of economy the following stations have recently been closed: Rockaway, Long Island; Yorktown, Va.; Cape May, N. J., and the marine station at Parris Island, S. C. With the same object in view, actual operation of aircraft from Lakehurst, N. J., has been eliminated, and all lighter-than-air operations at Pensacola, Fla., have been discontinued. Considerable reduction in the operation of planes at the stations at Hampton Roads, Va., and Coco Solo, Canal Zone, has been effected.

Fleet Air Forces

The work accomplished by the Atlantic and Pacific Fleet air forces has been most satisfactory. The Pacific Fleet air force devoted itself chiefly to the development of the ship planes, i. e., those planes that operate from battleships, the perfecting of the doctrine and tactics to be used in spotting of gun fire, while at the same time their large flying boats have successfully accomplished a long flight to the Canal Zone and return.

The work of the Atlantic Fleet air force has been in the nature of scouting and the offensive side of aviation, long-distance overseas flights, the development of doctrine and tactics for offensive bombing. This force also has accomplished successfully a long flight from Philadelphia to Panama and return. Aside from the flying involved in these long flights by both the Atlantic and Pacific air forces, the following additional problems have been undertaken:

(a) The bombing of the Indiana to determine the percentage of hits.

(b) The bombing and sinking of the U-117 and the search and dummy bombing of the radio controlled battleship Iowa.

(c) The development of smoke screens.

(d) The development of targets for anti-aircraft fire.

(e) The perfection of a torpedo for use from aircraft.

(f) The development of communications and direction finding from aircraft.

During the year the Marine Corps has made 3,364 flights, totaling 4,681 hours, or 300,285 miles.

A flight of two DH-4 planes successfully completed the trip from Washington, D. C., to Santo Domingo City, Diminican Republic, and return in 46 hours and 17 minutes.

Approximately 2,421,055 miles were flown by heavier-than-air craft, and 90,000 miles by lighter-than-air craft, or a total of 2,511,055 miles, at air stations and with the Fleet Air Squadrons, for the fiscal year ended June 30, 1921.

Aeronautical Board

Valuable work in preventing duplication and in reconciling aviation problems between the Army and Navy has been accomplished during the year by this interdepartmental board.

The National Advisory Committee, in which the Navy is represented, has rendered during the past year valuable assistance in scientific and technical matters pertaining to aviation.

Bureau of Aeronautics

In accordance with an act of Congress, the Secretary of the Navy issued orders for the establishment of a Bureau of Aeronatics to begin operations September 1, 1921. The organization was begun on that date with Rear Admiral William A. Moffet as chief of the Bureau. The establishment of this bureau is a very encouraging and important action on the part of the Government and the Navy Department. Inasmuch as it gives opportunity for coordinating activities concerning all aeronautical problems coming under the jurisdiction of the Navy, it reduces lost motion to a minimum and brings about economy of operation with a reduction in overhead costs, and at the same time places the chief of the bureau on a par with the chiefs of other bureaus in the Secretary's council.

The Bureau of Aeronautics realizes that the Government should do everything practicable to encourage and to stabilize the aviation industry of the United States. It is well understood that the risk involved to private concerns of experimental development has worked a hardship. In so far as may be possible, the Naval Aircraft Factory will be employed for the prosecution of experimental development. Actual production at the factory will be almost negligible. The Bureau of Aeronautics desires not to compete with commercial concerns, but to cooperate with them.

7,000 Mile Trip by Air is Started.

Lucien Sharpe, of Providence, R. I., intends to capture the title of the world's greatest air passenger. Last September Mr. Sharpe, who is wealthy, was mistaken for a prominent New York banker when he undertook a mysterious trans-European air voyage.

Mr. Sharpe left Le Bourget, the flying just outside of Paris, Dec. 12, on a two months' air tour which will take him more than 7,000 miles. He refused to comment on his trip beyond declaring that the railroads are too slow and uncomfortable to satisfy him. He is accompanied by the same pilot—Cobham—whom he employed on his trip last September. He will visit Toulouse, Madrid, Casablanca, Dakar, Oran, Algiers, Tunis, Brindisi, Athens, Constantinople and Bucharest, returning to Paris by way of Belgrade, Budapest, Vienna, Munich and Strasbourg.

GROUND INFLUENCE ON AEROFOILS*

By ARTHUR E. RAYMOND
Massachusetts Institute of Technology

(Technical Note of the National Advisory Committee for Aeronautics)

THE work leading up to the preparatoin of this report was done as a thesis by the author while a student in the Aeronautical Engineering course at the Massachusetts Institute of Technology. He wishes to acknowledge the assistance in preparing models, conducting tests, and preparing the report for publication, of Mr. Carl Selig, mechanic of the Department of Physics, Mr. Boris V. Korvin Kroukovsky, and Professor E. P. Warner, of the Department of Physics.

The question of ground influence on aeroplanes has recently attracted some attention in view of the claims made by certain designers that the landing speed of their aeroplanes is much decreased by an increase in lift coefficient due to the proximity of the ground in landing. As an illustration of this, in the description of the Pischoff Avionette given in *Aviation* for January 25, 1921, the statement is made that "the proximity of the lower wing to the ground, eight inches, causes the air imprisoned between the wing and the ground to act as a cushion." (The chord of the lower wing of this aeroplane is 2 ft. 4 m.) It has also been suggested that the difficulty experienced in landing some aeroplanes with high-lift wings, and notably those models with flap gears, may be due to such an increase in lift coefficient when approaching the ground, causing the aeroplane to stay off the ground while travelling nearly parallel to it for an abnormal length of time. Several investigations, discussed in detail later, have previously been undertaken on this point.† There seems to be room for another particularly to try out the relative merits of two possible methods of making ground influence tests.

The method of testing which first suggests itself is to set up a flat plate in the tunnel to represent the ground. This was one of the methods employed but the results obtained by it are not entirely satisfactory. Its fault lies in the fact that it is stationary with respect to the aerofoil, not to the wind. It represents the case in practice where the aeroplane lands in a wind of as great a velocity as its own air speed. Such a condition is fortunately rare and it is doubtful if the flow of air across the landing field at such a time would approximate the flow around a flat plate in the wind tunnel.

A method giving results of more practical value was found in the reflection method. Considering the ground plane as a mirror in which the aerofoil to be tested is reflected in a duplicate aerofoil placed in the position of its image, two wings are placed symmetrically in the tunnel, with the ground plane considered as the plane of symmetry half way between them. Forces are read on one only and whenever the angle of attack of one is altered the angle of the other is changed correspondingly. The ground plane in this case being imaginary, no error is introduced on account of skin friction, as in the flat plate method. The reflection method was found to give two slightly different types of flow at high lift angles, due to disturbance of the plane of symmetrical air flow by vortices, but it is believed that the results show it to give a closer approximation to ground plane influence than does a flat plate.

All tests were made in the 4 ft. tunnel at the Massachusetts Institute of Technology. Wind velocity through the tunnel was in all but two tests 30 m.p.h. In an effort to obtain satisfactory readings on one of the wings at an angle of discontinuity the velocity was increased in these two tests to 40 and 45 m.p.h. The effort was successful but overheated the motor driving the tunnel propeller, and it was not attempted again.

The dimensions of the three models used were 3 in. by 18 in. The models were:

1. Martin No. 2. A thick section wing fitted with flap gear. The duplicate wings used were very accurately made and agree with the specified ordinates to within 2%.

2. R.A.F. 15 Special. A double-chambered moderately thin wing. The models used were old ones, both quite warped, but were placed in the tunnel warped in the same direction and were very nearly the same distance apart at all points along their span.

3. U.S.A. 27. These models were very inaccurately made and are not true U.S.A. 27 aerofoils, but served well enough for the purpose in hand.

Flat plate method. A piece of three-ply birch ⅜ in. thick, 4 ft. high, 3 ft. wide, was used. The leading edge was chamfered on the side way from the model. Small wooden strips were attached to the top and bottom and screwed to the ceiling and floor of the tunnel, maintaining the plywood flat and at the proper distance from the aerofoil.

Reflection method. The aerofoil to be tested was mounted on the spindle of the balance in the usuel way and the reflecting wing placed on a spindle mounted with a graduated head, on an auxiliary wooden fairing having a brass floor plate. After each reading the wind in the tunnel was shut down while the reflecting wing was shifted to its new angle of incidence. In all comparative tests the single wing was tested immediately before the reflecting wing was put in place.

For tests made at a fixed angle of incidence, with the wings

* Submitted as a thesis in the graduate course in Aeronautical Engineering in 1921, and published by permission of the Department of Physics at the Massachusetts Institute of Technology.

† "Ground Effect on Wings," by A. A. Merrill, The Ace, December, 1920; "Ground Influence on Wings," by the Aerodynamics Staff, Report No. 173; "Wind Tunnel," Navy Yard, Washington, D. C.

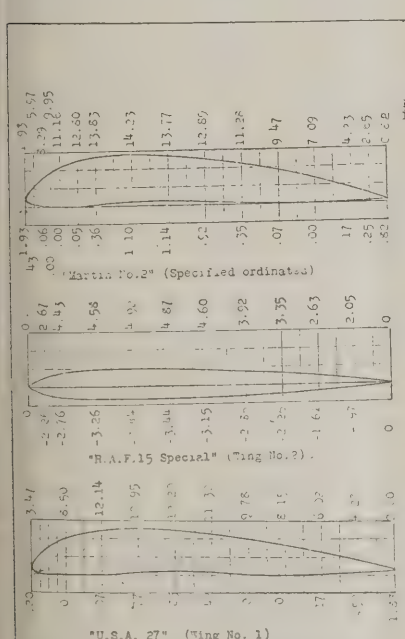


Fig. 1. Aerofoil tested for ground effect.

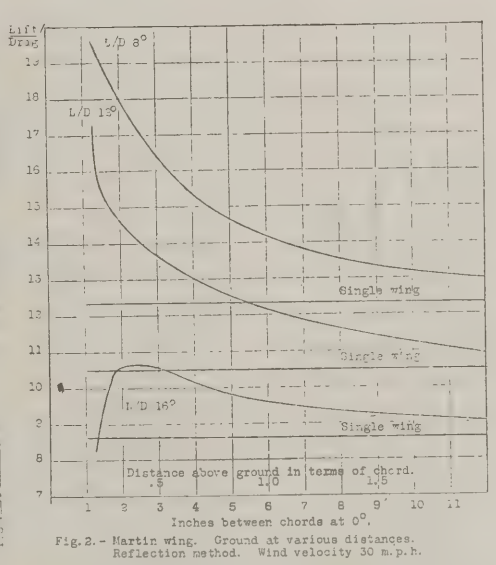


Fig. 2.- Martin wing. Ground at various distances. Reflection method. Wind velocity 30 m.p.h.

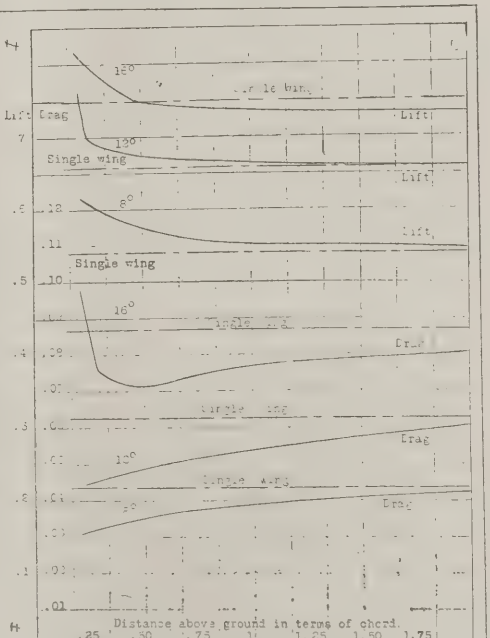


Fig. 3. Martin wing. Ground at varying distance Reflection method. Flaps neutral. Readings on Wing Wind velocity 30 m.p.h.

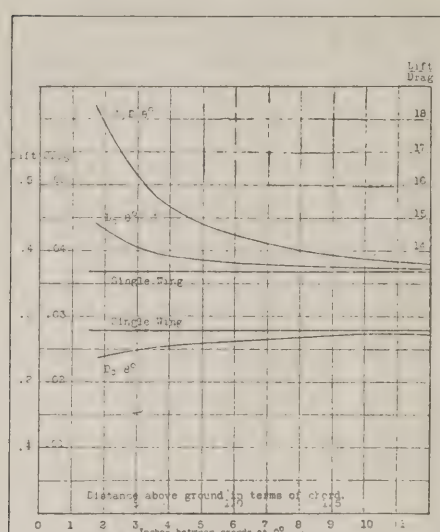


Fig. 4.- R.A.F. 15 Special ground at various distances Reflection method. Wind velocity 30 m.p.h. Reading on Wing 2.

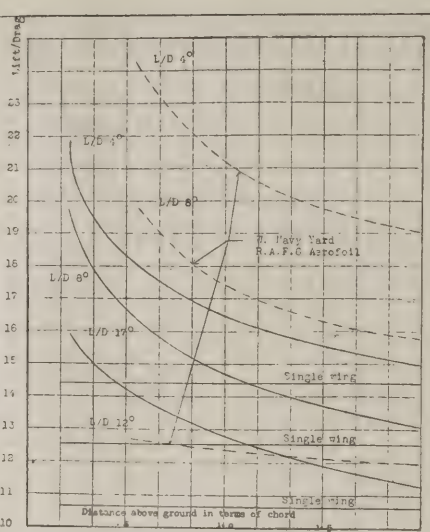


Fig. 5. U.S.A. 27 Ground at various distances. Reflection Method Wind velocity at 30 m.p.h.

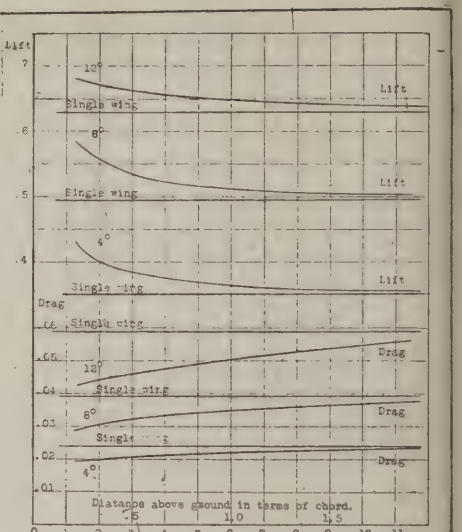


Fig. 6. U.S.A. 27. Ground at varying distance (Reflection Method) Readings on Wing 1. Wind velocity 30 m.p.h.

at a varying distance apart, the reflecting wing, its spindle, and graduated head were mounted on a brass rail running from the center fairing to a second fairing placed near the tunnel wall. This brass rail was graduated for distances between spindle centers of from 1.75 to 16.00 inches. It was found that the apparatus holding the reflecting wing caused no measurable influence upon the other wing.

In running a test at a fixed distance it was found best to keep the distance between spindles or from spindle to plywood constant. The wings being lined up at 0° before each test, the distance was measured from chord to chord at that angle and not from spindle to spindle. The position of the spindle (center of rotation) for each aerofoil is given below and a chart is appended for determining the distance between trailing edge and ground in each case:

	—Center of Rotation—	
Wing	*Back of L.E.*	*Above Chord*
Martin No. 2.....	1″	0.25″
R. A. F. 15 Special.....	1″	0.00″
U. S. A. 27.....	1″	0.20″

In plotting results, absolute coefficients are used throughout.

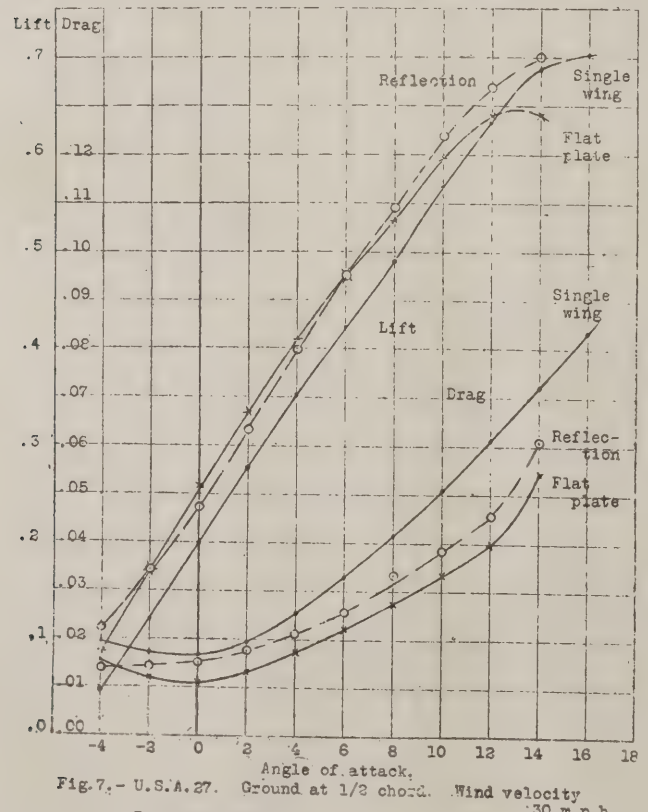


Fig. 7.- U.S.A. 27. Ground at 1/2 chord. Wind velocity 30 m.p.h. Reading on Wing 1.

Reflection method. Considering first the tests made with the ground at ½ chord: The most marked effect is an increase in L/D of from 35% to 40% at angles ranging from —4° to maximum lift. This is caused by an increase in lift and a decrease in drag. The increase in lift is greatest at small angles, weakening perceptibly as the burble angle is approached. The decrease in drag, on the other hand, is most marked at high angles, the combined effect being an increase in L/D of substantially a constant percentage.

Maximum lift is increased little, if any, at ½ chord ground distance, but there is a tendency to shift it to a smaller angle.

The Martin wing (flap neutral) at 30 m.p.h. showed an increase in maximum lift at ½ chord, but at 40 and 45 m.p.h. this did not occur. While making tests at 14° and 16° at varying distance two types of flow were observed, which account for this on the supposition that the ground plane of symmetry is easily broken up at high angles and speeds by the intermingling of vortices from the two reflecting wings. If this be true, the type of flow which gives an increased lift is the one for which the vortices do not intermingle, and therefore corresponds to the ground influence felt by a full-size aeroplane.

Turning to the tests made at varying ground distances as given in Fig. 3, a noticeable fact is the speed with which the ground influence increases as the wing comes within 1.2 chord of the ground. The effect on lift is very slight at 2 chords, but that on drag is still considerable. The curves approach asymptotically the single wing values, as would be expected with the exception of the 16° lift curve, which for distances greater than ½ chord lies below this value. The single wing lift was checked carefully after the test and is correct.

The drag curve for this same test is also interesting. The sharp upward bend as the ground distance becomes less than half a chord is probably due to stoppage of the air flow, for the trailing edge of the wing at this angle and these distances are very close to the ground.

The diminution of effect on lift and increase of effect on drag with increasing angle for the U. S. A. 27 aerofoil is shown very nicely in Fig. 6.

(*Concluded on page* 376)

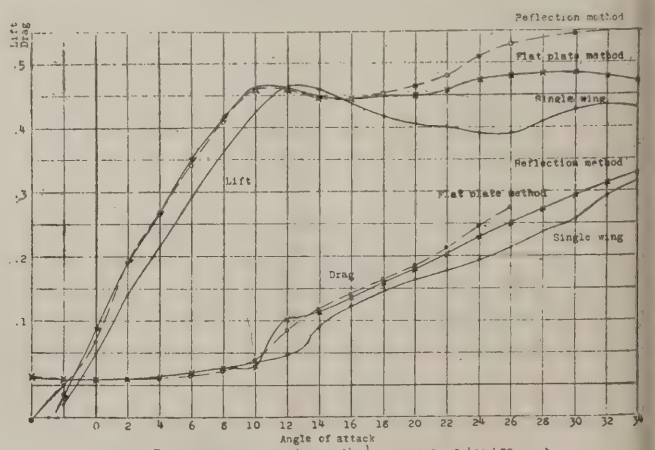


Fig. 8. R.A.F. 15 Special. Ground at 1/4 chord. Wind velocity 30 m.p.h. Readings on wing 2.

LANDING FIELDS IN CANADA

The following is a list of air harbors licensed by the Air Board of Ottawa, Canada, corrected to September 30, 1921:

REGINA, SASKATCHEWAN, *commercial air harbor.*—Situated southwestward of the city of Regina, Saskatchewan, near the Parliament Buildings. Latitude 50° 25′ N., longitude 104° 39′ W. Altitude 1,890 feet above sea level. Local magnetic variation 19° 02′ E. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is three feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone connection. Water and fuel supply. Hangar accommodation and facilities for minor repairs only. Available communication to city of Regina—electric railway, motor transport, good roads.

Licensee—Aerial Service Co., Box 285, Regina, Saskatchewan.

SASKATOON, SASKATCHEWAN, *commercial air harbor.*—Situated 2 miles northwestward of Saskatoon Post Office. Latitude 52° 08′ N., longitude 106° 43′ W. Altitude 1,640 feet above sea level. Local magnetic variation 23° 05′ E. Maximum dimensions for landing 300 by 400 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telephone 5221. Telegraph and telegraphic address— McClelland Aircraft, 104 Cobbold Block, Saskatoon, Saskatchewan. Water and fuel supply. Facilities for repair to Curtiss J. N. 4 machines. Accommodation for one machine. Available communication to the city of Saskatoon. Motor transport, dirt roads.

Licensee.—McClelland Aircraft (Ltd.), 104 Cobbold Block, Saskatoon, Saskatchewan.

EDMONTON, ALBERTA, *commercial air harbor.*—Situated on St. Albert Trail 3½ miles northwestward of Edmonton Post Office. Latitude 53° 35′ N., longitude 113° 33′ W. Altitude 2,215 feet above sea level. Local magnetic variation 27° 0′ E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telegraph and telegraphic address— May-Gorman Aeroplanes (Ltd.), 10327 Ninety-ninth Avenue, Edmonton, Alberta. Telephone connection. Water and fuel supply. Facilities for minor repairs only. Hangar accommodation. Available communication to city of Edmonton. Motor transport, electric railway ½ mile southeastward of aerodrome, good roads.

Licensee.— May-Gorman Aeroplanes (Ltd.), 10327 Ninety-ninth Avenue, Edmonton, Alberta.

HANNA, ALBERTA, *commercial air harbor.*—Situated ¾ mile southeastward of the town of Hanna, Alberta. Latitude 51° 38′ N., longitude 111° 56′ W. Altitude, 2,677 feet above sea level. Local magnetic variation, 24° 05′ E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address—Holbrook & McLeod, Hanna, Alberta. Water and fuel supply. Facilities for minor repairs to Curtiss J. N. 4's. Accommodation for one machine. Available communication to town of Hanna—motor transport, good roads.

Licensee.—Holbrook & McLeod, Hanna, Alberta.

MONTREAL, PROVINCE OF QUEBEC, *customs air harbor.*—Latitude 45° 30′ N., longitude 73° 40′ W., approximately 7 miles north of the city of Montreal, near the town of St. Laurent. Altitude, 140 feet above sea level. Local magnetic variation, 15° 35′ W. Dimensions, 750 yards north and south by 400 yards east and west. Licensed for use by day only and marked with double cross-barred square surrounding a circle. See Diagram of Markings, Ref. No. 20.

Customs personnel on duty only when notified at Montreal customhouse. Telephone, gasoline, oil, and water supplies are available and handling party is stationed on the aerodrome. There are two hangars in north end of aerodrome. Repairs can be carried out. A wind indicator is placed on northwest corner.

Communication.—Road, steam and electric railway.

Licensee.— Canadian Division of the Aerial League of the British Empire.

Operated by R. & W. Air Service.

ARMOUR HEIGHTS, ONTARIO (NEAR TORONTO), *customs air harbor.*—Latitude 43° 43′ N., longitude 79° 24′ W., about 1½ miles northwestward of Stop 26, Metropolitan Railway, York Township, Ontario. Altitude, 540 feet above sea level. Local magnetic variation, 6° 40′ W. Dimensions, 400 yards in circular diameter. Licensed for use by day only and marked with a square and circle inserted, divided in equal parts by a vertical line. See Diagram of Markings, Ref. No. 21.

Customs personnel on duty only when notified at Toronto customhouse. Directional wind indicator in northeastern corner. Telephone connection and water supply. There are facilities for repairs, fuel supply and machine accommodations, and a handling party is stationed on the aerodrome.

Available communication to city—Electric railway, 1 mile from aerodrome. Good roads.

Licensee.— Bishop-Barker Aeroplanes (Ltd.), 93 Spadina Avenue, Toronto, Ontario.

WINNIPEG, MANITOBA (RIVER PARK), *commercial air harbor.*—Situated at River Park, western edge of the city of Winnipeg. Latitude 49° 51′ N., longitude 97° 08′ W. Altitude 760 feet above sea level. Local magnetic variation 12° 07′ E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by two straight lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address — Winnipeg Airco (Ltd.), 408 Confederation Life Building, Winnipeg, Manitoba. Water and fuel supply. Facilities for minor repairs only. Hangar accommodation. Available communication to city of Winnipeg—electric railway, motor transport, paved roads.

Licensee.—Winnipeg Airco (Ltd.), 408 Confederation Life Building, Winnipeg, Manitoba.

WINNIPEG, MANITOBA, *commercial air harbor.*—Situated 5 miles in a westerly direction from corner Portage Avenue and Main Street, Winnipeg. Latitude 49° 53′ N., longitude 97° 18′ W. Altitude 776 feet above sea level. Local magnetic variation 13° 0′ E. Maximum dimensions for landing—500 by 300 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on pole near hangar. Telephone N. 6415. Telegraph and telegraphic address Canadian Aircraft Co. (Ltd.), 43 Aikens Building, Winnipeg, Manitoba. Water and fuel supply. Facilities for repairs. Accommodation for two machines. Available communication to city of Winnipeg —electric railway, motor transport, paved roads.

Licensee.— Canadian Aircraft Co. (Ltd.), 43 Aikens Building, Winnipeg, Manitoba.

LAC A LA TORTUE, PROVINCE OF QUEBEC, *commercial seaplane station.*—Situated ¼ mile east of Lac a la Tortue and 3 miles southeast of Grand Mere, Province of Quebec. Latitude 46° 36′ N., longitude 72° 40′ W. Altitude 430 feet above sea level. Local magnetic variation 18° 02′ W. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle each side of which is 3 feet wide and 25 feet long (inside measurement). See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone number 109 ring 31. Water and fuel supply. Facilities for minor repairs. Hangar accommodation. Handling partly stationed at air harbor. Available communication—good roads (sand), taxis to village.

Licensee.—Laurentide Co. (Ltd.), Grand Mere, Province of Quebec.

VIRDEN, MANITOBA, *customs air harbor.*—(Latitude 49° 50′ N., longitude 100° 50′ W.) about 1½ miles south of the town of Virden, Manitoba. Altitude, 1,450 feet above sea level. Local magnetic variation, 16° E. Dimensions, 800 yards north and south by 800 yards east and west. Licensed for use by day only and marked with a square and enclosed circle. See Diagram of Markings, Ref. No. 23.

Customs personnel on duty only when notified at the customs subcollector's office. Directional wind indicator in northwest corner. Telephone connection, fuel, and water supply. Facilities only for minor repairs. No hangar accommodation. Road communication good. Rail communication, C. P. R.

Licensee.—Town of Virden.

SAULT STE. MARIE, ONTARIO, *commercial seaplane station.*—Situated on St. Mary's River, near the Imperial Oil Co.'s dock. Latitude 46° 31′ N., Iongitude 84° 21′ W. Altitude, 583 feet above sea level. Local magnetic variation—3° W. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilaterial triangle each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Telephone connection. Telegraph and telegraphic address—Spanish River Pulp & Paper Mills (Ltd.), Sault Ste. Marie, Ontario. Water and fuel supply. Moor-

ing accommodation. Facilities for minor repairs. Available communication to city of Sault Ste. Marie, Ontario—Electric railway, 200 yards in a northerly direction, motor transport, good roads.

Licensee.—Spanish River Pulp & Paper Mills (Ltd.), Sault Ste. Marie, Ontario.

BRANDON, MANITOBA. *commercial air harbor.*—Situated ½ mile westward of city of Brandon, on Victoria Avenue. Latitude 49° 50′ N., longitude 99° 58′ W. Altitude 1,204 feet above sea level. Local magnetic variation, 15° 07′ E. Maximum dimensions for landing—400 by 600 yards. Licensed for use by day only and marked with a triangle divided by a vertical line. See Diagram of Markings, Ref. No. 26.

Directional wind indicator on hangar. Telephone number 2301. Telegraph and telegraphic address—Brandon Aerial Services, Prince Edward Hotel, Brandon, Manitoba. Facilities for top overhauls only. Water and fuel supply. Accommodation for one or two machines and a handling party stationed on the aerodrome. Available communication to the city of Brandon—electrict railway, motor transport, and good roads.

Licensee.—Brandon Aerial Services, Prince Edward Hotel, Brandon, Manitoba.

CHICOUTIMI, PROVINCE OF QUEBEC, *commercial seaplane station.*—Situated on the Saguenay River, westward of the town of Chicoutimi, Province of Quebec. Latitude 48° 30′ N., longitude 71° 05′ W. Altitude—sea level. Local magnetic variation 21° 04′ W. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone number, 437 Chicoutimi. Fuel and water supply. Facilities for minor repairs. Hangar accommodation. Type of transport available locally—train, taxis, Saguenay River boats.

Licensee.—Price Bros. & Co. (Ltd.), Chicoutimi, Province of Quebec.

ROCKLIFFE, OTTAWA, ONTARIO, *aeroplane and seaplane station.*—Situated on the right bank of the Ottawa River, eastward of Rockliffe Rifle Range butts, opposite the center of Kettle Island. Latitude 45° 28′ N., longitude 75° 39′ W. Local magnetic variation 13° 07′ W. Altitude 200 feet above sea level. Maximum dimensions for landing 700 by 400 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on top of Rockliffe Rifle Range butts. Water and fuel supply (pipe line for seaplanes). Hangar and mooring accommodation. Handling party stationed on the aerodrome. Available communication to the city of Ottawa—electric railway, motor transport, good roads.

Licensee.—The Air Board, Ottawa, Ontario.

ENGLISH BAY (VANCOUVER), BRITISH COLUMBIA, *seaplane station.*—Situated at Jericho Beach near Vancouver. Latitude 49° 16′ N., longitude 123° 17′ W. Altitude—sea level. Local magnetic variation 25° 00′ E. Maximum dimensions for landing—over 4 miles square. Licensed for use by day only and marked with a triangle. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on boathouse. Telephone, Bayview 4228. Telegraph and telegraphic address—Air Board Station, Jericho Beach, Vancouver, British Columbia. Water and fuel supply. Repair facilities. Hangar accommodation and a handling party at station. Available communication to the city of Vancouver—motor transport, motor boats, paved roads.

Licensee.—The Air Board, Ottawa, Ontario.

DESERONTO, ONTARIO, *customs air harbor* (latitude 44° 10′ N., longitude 77° 08′ W.).—About 3½ miles westward of the town of Deseronto, Ontario. Altitude 260 feet above sea level. Local magnetic variation 10° 30′ W. Dimensions, 440 yards north and south by 800 yards east and west. Licensed for use by day only and marked with a double cross-barred square and enclosed circle. See Diagram of Markings, Ref. No. 20.

Customs personnel on duty only when notified at Deseronto custom-house. Directional wind indicator in southeastern corner. Telephone connection, fuel, and water supply. Road communication good; rail communication—C. N. R. 50 yards. Facilities for general repairs.

Licensee.—G. H. Harrold, Deseronto, Ontario.

YORKTON, SASKATCHEWAN, *commercial air harbor.*—Situated on the northern half of section 18, township 26, range 3, westward of the 2d. Latitude 51° 16′ N., longitude 102° 33′ W. Altitude 1,655 feet above sea level. Local magnetic variation 19′ 02° E. Maximum dimensions for landing—under 300 yards. Licensed for use by day only and marked with a triangle divided by two straight lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Telephone connection. Telegraph and telegraphic address—Yorkton Aerial Transport Co., Yorkton, Saskatchewan. Water and fuel supply. Facilities for minor repairs only. Available communication to the town of Yorkton—motor transport, dirt roads.

Licensee.—Donald Brown, Yorkton, Saskatchewan.

LETHBRIDGE, ALBERTA, *commercial air harbor.*—Situated at Lethbridge Exhibition Grounds, 2 miles eastward of the city of Lethbridge. (Latitude 49° 40′ N., longitude 112° 50′ W.) Local magnetic variation 23° 15′ E. Maximum dimensions for landing—600 by 800 yards. Licensed for use by day only and marked with a triangle containing a circular dot in the center. See Diagram of Markings, Ref. No. 27.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address—Lethbridge, Aircraft Co. (Ltd.), Lethbridge, Alberta. Water and fuel supply. Facilities for minor repairs only. Hangar accommodation. Available communication to the city of Lethbridge—motor transport, good roads, electric railway ½ mile west of aerodrome.

Licensee.—Lethbridge Aircraft Co. (Ltd.), Lethbridge, Alberta.

FREDERICTON, NEW BRUNSWICK, *customs air harbor (seaplane).*—(Latitude 45° 30′ N., longitude 66° 39′ W.) Situated on the St. John River—on the western side of Fredericton Highway Bridge. Altitude 18 feet above sea level. Local magnetic variation 21° W. Dimensions—over 800 yards north and south and over 800 yards east and west. Licensed for use by day only and marked with a circle enclosed in a square. See Diagram of Markings, Ref. No. 23.

Customs personnel on duty when notified at the collector of customs' office, Fredericton. Telephone, gasoline, oil, and water supplies. Power launch and two mooring buoys available. A wind indicator is placed on the southern shore of the St. John River, approximately 600 yards westward of Fredericton Highway Bridge.

Communication.—Road and railway—C. N. R. and C. P. R. Station half a mile southward of the air harbor.

Licensee.—City of Fredericton.

DARTMOUTH, NOVA SCOTIA, *seaplane station.*—Situated 4 miles southeastward of the city of Dartmouth, opposite northern end of McNab Island. Latitude 44° 38′ N., longitude 63° 31′ W. Local magnetic variation 22° 07′ W. Altitude—sea level. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Directional wind indicator on hangar. Telephone connection. Telegraph and telegraphic address—Air Board Station, Dartmouth, Nova Scotia. Water and fuel supply. Facilities for repairs. Hangar accommodation and a handling party stationed at the air harbor. Available communication to the city of Dartmouth—motor transport, good roads.

Licensee.—The Air Board, Ottawa, Ontario.

HAMPSTEAD, PROVINCE OF QUEBEC, *commercial air harbor.*—Situated ½ mile northward of the town of Hampstead (near Montreal), Province of Quebec. Mount Royal 2 miles southeast. Blue Bonnet Race Track ½ mile north. Latitude 45° 33′ N., longitude 73° 42′ W. Altitude 125 feet above sea level. Local magnetic variation 15° 09′ W. Maximum dimensions for landing, under 300 yards. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Water and fuel supply. Facilities for running repairs only. No machine accommodation. Available communication to the city of Montreal—¼ mile to electric railway; good roads.

Licensee.—Plante Aerial Service, 161 Craig Street West, Montreal, Province of Quebec.

HIGH RIVER, ALBERTA, *commercial harbor.*—Situated 2½ miles northeastward of the town of High River, Alberta. Latitude 50° 36′ N., longitude 113° 51′ W. Local magnetic variation 24° 02′ E. Altitude 3,394 feet above sea level. Maximum dimensions for landing—600 by 800 yards. Licensed for use by day only and marked with a triangle with a circular dot in the center. See Diagram of Markings, Ref. No. 27.

Directional wind indicator on pole near hangar. Telephone number, High River 187. Telegraph and telegraphic address—Air Board Station, High River, Alberta. Water and fuel supply. Repair facilities for D. H. 4's and Rolls-Royce engines. Machine accommodation and a handling party stationed on the aerodrome. Available communication to the town of High River—motor transport, graded dirt roads.

Licensee.—The Air Board, Ottawa, Ontario.

Moose Jaw, Saskatchewan, *customs air harbor.*—(Latitude 50° 24′ N., longitude 105° 34′ W.) Situated in Lynbrook Heights, addition to the city of Moose Jaw. Altitude 1,865 feet above sea level. Local magnetic variation, 20° 15′ E. Dimension—400 yards north and south and 700 yards east and west. Licensed for use by day only and marked with a square and circle inserted divided in equal parts by a vertical line. See Diagram of Markings, Ref. No. 21.

Customs personnel on duty when notified at the collector of customs' office, Moose Jaw. Directional wind indicator on western side of aerodrome. Telephone connection and water supply. There are facilities for repair, fuel supply, and machine accommodation, and a handling party is stationed on the aerodrome.

Available communication to city—Electric railway adjoining aerodrome. Good roads.

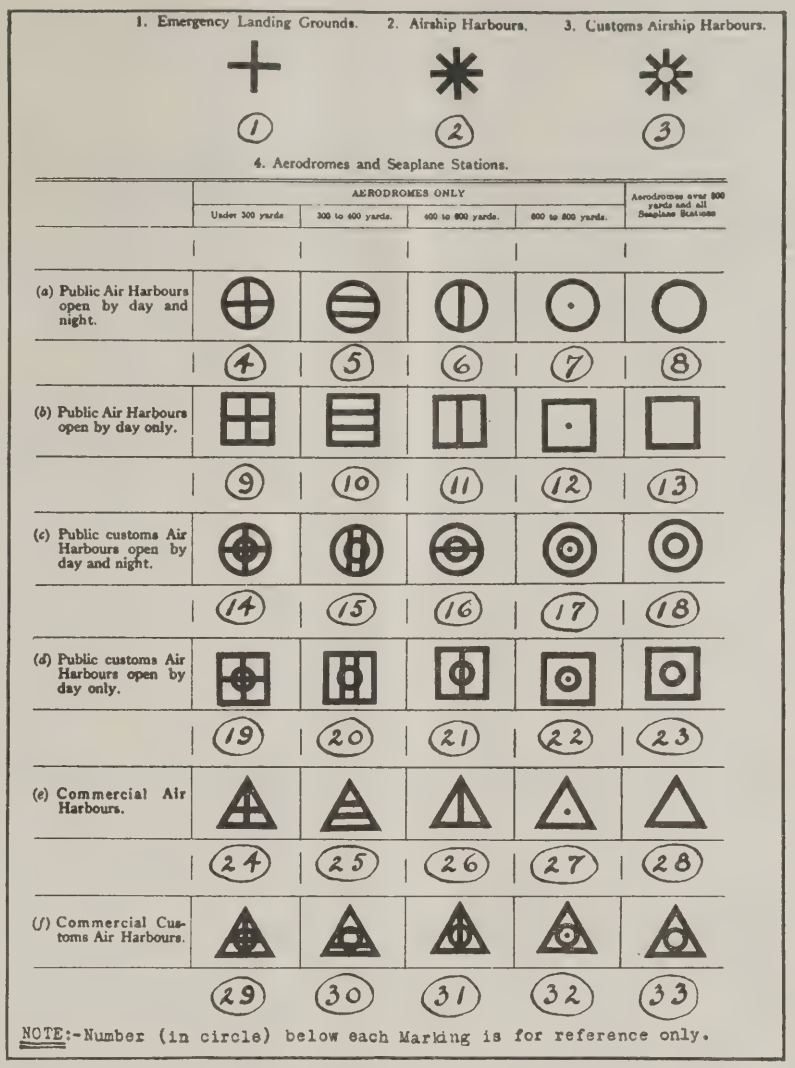
Licensee.—City of Moose Jaw, Saskatchewan.

Operated by the Western Aeroplane Co. (Ltd.), Moose Jaw, Saskatchewan.

Bowness Park, Alberta, *commercial air harbor.*—Situated 6 miles westward of Calgary, Alberta. Latitude 51° 06′ N., longitude 114° 13′ W. Altitude 3,765 feet above sea level. Local magnetic variation —25° E. Maximum dimensions for landing—300 yards square. Licensed for use by day only and marked with a triangle divided by a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Directional wind indicator on hangar; telephone number, 3505. Water and fuel supply. Facilities for minor repairs only. Accommodation for two light machines. Available communication to the city of Calgary—electric railways adjoining aerodrome, dirt and asphalt road.

Licensee.—McCall-Hanrahan Aero Service, 515 Grain Exchange Building, Calgary, Alberta.



Diagrams Showing the Markings of Canadian Air Harbors

Burrard Inlet, Vancouver, British Columbia, *commercial seaplane station.*—Situated at the foot of Burrard Street, on Burrard Inlet, Vancouver Harbor, Latitude 49° 16′ N., longitude 123° 06′ W. Altitude—sea level. Local magnetic variation 25° 00′ E. Maximum dimensions for landing—approximately two square miles. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long (inside measurement). See Diagram of Markings, Ref. No. 28.

Directional wind indicator—conical streamer on hangar. Water supply; facilities for overhauling Curtis OX5 engines; fuel supply and accommodation for one machine.

Available communication to city of Vancouver—electric railway and paved roads.

Licensee.—The Aircraft Manufacturers (Ltd.), 1004 Standard Bank Building, Vancouver, British Columbia.

(*Concluded on page* 379)

AERONAUTIC ROADS—BLOCK SYSTEM

Addenda to Article of Aug. 22, 1921—Aerial Age Weekly

TO avoid duplicate markers, the following method can be adopted. Referring to the map accompanying the article of Aug. 22, the southern transcontinental line traverses blocks 16, 8, 7, 17 and 25. If the posting is done on a single line of tower locations starting, for example, with towers 25, 24, 23, 22 and 21 of 100-mile blocks F, E, B and A of block 16, these same numbers will be repeated in blocks 8, 7, 17 and 25, but if an offset is made between the major blocks, we will strike different tower numbers; for example, at the junction of blocks 16 and 8 a side step can be taken to the next line of locations, which will be a 20-mile offset, say to the north, and we will then strike locations 20, 19, 18, 17 and 16 of the 100-mile blocks F, E, B and A in block 8. Then coming to block 7 let there be another 20-mile offset to the north and the tower location will be at points 15, 14, 13, 12 and 11 of F, E, B and A. Again at block 17 another 20-mile offset, bringing the line on to locations 10, 9, 8, 7 and 6; and another jump at block 25, shifting the line to locations 5, 4, 3, 2 and 1. Then finally at block 31 another offset to locations 25, 24, 23, 22 and 21 of blocks P and O.

There will then be no duplicate markers at any point on the line. The same method can be followed with respect to north and south lines.

If a lane is posted with alternate right and left location at 40-mile intervals on the side lines, then at the junction of two blocks the alternations can be reversed. This will avoid duplicate marking for a stretch of 800 miles, and the line can then be shifted to an entirely different set of locations.

Aeronautic Roads, A Continental System

The project for posting the country should be considered from a continental standpoint and the cooperation of Canada and Mexico invited, so that in its development it will become a homogenous system for the Continent and the Continental Islands, without breaks at the national borders.

All markers, whether in Newfoundland, British Columbia, Missouri, Tamaulipas or Sinaloa, should be alike in character and significance. This does not mean the marking of installations under a joint commission but simply an agreement as to the general plan and marker details.

Each country will have its own series of major blocks with uniformity in block subdivisions and marker devices. A border block can carry, with respect to the respective countries, the number pertain-

ing to that system. Thus block 1 of the U. S. system, as projected, covers in the United States, portions of North Dakota and Minnesota; and in Canada portions of Manitoba and Saskatchewan. If the number for this block, in the Canadian system is, for example, "16," "1 P 22" will identify a marker in Western Minnesota, and "16 A 10" (Canadian) a marker in the same block, near the Manitoba-Saskatchewan line.

In referring to a Mexican or Canadian location, from our standpoint, a prefix identifying the system can be used, for example, "Mex. 2 D 23" or "Can. 16 A 10."

Urban and Industrial Districts and Inside Markers

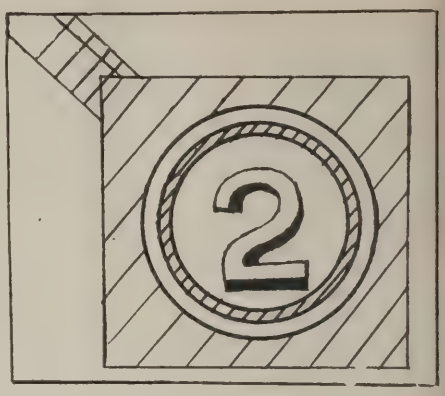
It is very possible that industrial districts may take up the posting of their territory, so that an aviator approaching the district can get his bearings. For example, take the Birmingham District, including Bessemer, Ensley, Pratt City, etc., Alabama. If this is surrounded by a cordon of markers, a flier, from whatever direction he approaches, can get his bearings and locate the landing field.

In some cases it may be desirable to provide markers within the confines of a 20-mile block; for example, in proximity to the landing field. Most of this Birmingham District lies in block "16 C 2," for which the platform contour is a square with an arm to the northwest. A marker within this block can show the same indications, a square platform with an arm to the northwest and the central number "2." To show that it is an auxiliary marker, the platform can be made with an inside ring around the number, and a narrow annual space between the ring and the platform proper. This device can be used for all inside markers, indicating that the marker is within the area of the block indicated, the position of same being shown on the map.

An "X" after a marker designation will indicate that it is an inside marker, generally in proximity to a landing field, within the 20-mile block. Thus, "16 C 2 X" refers to a marker for the landing field for the Birmingham District.

Maps

The keeping of aeronautic maps up to date will be a simple matter. As installations are made, the location designations will be published by the press as



items of general interest and the airmen will mark the new installations on their maps.

Alaska

A project that should be given attention is the posting of Alaska. For example, the route from Seattle up the coast to Juneau, and from there to Seward, Fairbanks and Nome. The block system can be extended to cover this territory.

THE WORK OF THE FOREST PRODUCTS LABORATORY

FOR more than 10 years the Forest Products Laboratory at Madison, Wisc., has been studying wood, always with the object of developing its most efficient and economical use. During that period it has amassed a great deal of scientific information of the most practicable application. Great credit is conceded the Laboratory for its research accomplishments but in the final analysis the value of its work must be measured by the extent to which the results of its work are made known and effectively applied by the wood manufacturing industries. It is believed that this phase of the Laboratory's work is not being developed to an extent which its research results and industrial needs justify.

It is well recognized that those in charge of the work at the Laboratory have been endeavoring to remedy this situation as evidenced by the information disseminated currently through trade and technical publications, by direct distribution of technical notes, by instructional courses in box construction and kiln drying, and in the facilities offered for direct cooperation in applying its information to specific manufacturing problems. In order to develop its dissemination work even to this extent, it has been necessary for the Laboratory in certain cases to require cooperators to bear the cost of dissemination. This of necessity limits the broad usefulness of the Laboratory and tends to restrict its information and services to the relatively few individuals and companies which are conversant with its work and the value of its results.

This is a situation which ought not to exist. It is one easily remedied, and the remedy lies in a specific appropriation by Congress for the dissemination and application of the Laboratory's results commensurate with its research activities and accomplishments.

The application of research is largely a matter of education, and when research is conducted as a governmental activity, adequate facilities must be provided for carrying the results through to their commercial application. This seems so thoroughly established as to forego argument. In its agricultural research and development the Department of Agriculture has solved the problem in a highly satisfactory and profitable way by placing county agents in every state in the Union, whose duties are to advise and educate the farmers in better methods of farming.

There is at Madison, we understand, a great deal of information which it has never been possible to supply the industries, because the Laboratory has not had the money or men to put this information in usable shape for the business man. We believe that the Laboratory should have at Madison an adequate force to prepare all its data of practical application in a form which the business man can readily grasp and apply. We believe that in addition, the Laboratory should have a group of men whose whole time is devoted to field work. The duties of these men should be to carry the information, now available at the Laboratory and being made use of by the relatively few, to the men in the sawmill, or in the lumber yard, or in the wood using plant. Personal contact, after all, is the most effective means of disseminating practical, scientific information. Members of the Laboratory and of the industries who have come together personally are first to admit this. But relatively few of the industries have the means or inclination to go to Madison and there investigate for themselves the information which they may make use of.

As concrete examples of some of the ways by which the dissemination of the Laboratory's work should be developed, the following are mentioned: expansion of its instructional work in kiln drying, box construction, and special co-operative tests under a plan by which the expense is at least shared equally by the Government and the co-operator; the assignment of Laboratory field representatives to disseminate its results by personal contact in such fields as the preservation of mine timbers, the kiln drying of lumber, the proper working values of wood in building codes, the protection of wood pulp and pulpwood from decay in storage; and the demonstration on a commercial scale of the Laboratory's work in developing improved processes, such as the cooking and bleaching of southern pine for magazine and book paper, increasing the yield of wood alcohol in destructive distillation, the utilization of sawdust and mill waste for cattle food, and the de-inking of old magazines and newspapers so that the stock may be reused.

The current annual appropriation for forest products research amounts to $325,000. This is equivalent to less than 25 cents for every $1000 of raw manufactured value for the total annual cut of wood. On the other hand, the Department of Agriculture is spending for agricultural research and development $1.50 for every $1000 of value of all agricultural and animal products.

We believe that for the reasons already stated the Laboratory's appropriation should be increased a minimum of $100,000. The Secretary of Agriculture and the Director of the Budget have approved $340,000 for the research work of the Laboratory for the fiscal year beginning July 1, 1922. These estimates will be presented to the new Congress early in December. They are contained in the estimates for the Forest Service, U. S. Department of Agriculture, and will be considered first by the Sub-committee on Agriculture of the House Committee on Appropriation and later by the Senate Committee on Agriculture. The Honorable Sidney Anderson of Minnesota is chairman of the House Sub-committee.

Those interested in the effective continuation and development of the Forest Products Laboratory should see that their local representatives in Congress are impressed with the importance not only of providing the normal appropriations for its work but in urging the moderate increase for the special purposes outlined.

NOTE—This statement prepared and distributed by the Association of Wood Using Industries.

NAVAL and MILITARY AERONAUTICS

Germans to Build Zeppelin for U. S.

Washington, Dec. 17.—Authorization by the Allied Council of Ambassadors for the construction by Germany of a Zeppelin of the L-70 type for the United States was regarded in official circles here as a distinct triumph for American diplomacy.

By virtue of that authorization Germany is permitted to go behind the terms of the protocol signed in Paris last June, which limited the size of airships she might built to 30,000 cubic meters capacity. The airship which Germany will build for the United States is to be of 70,000 cubic meters capacity.

The opposition of the European Governments was overcome by repeated representations by Ambassador Herrick that this country would not use the new airship for military purposes and that America was entitled to compensation in kind for the Zeppelin awarded this Government and later destroyed by Germany.

Under the decision of the Council of Ambassadors Germany will construct a Zeppelin of the L-70 type at the Friedrichshafen hangar, the only one in Germany large enough to permit the building of an airship of that size, and then will tear down the hangar and disperse the mechanics brought together to fabricate the air monster. The completed airship will be delivered to the United States in Germany without the expenditure of a single penny by this Government, it was stated, and then will be flown across the Atlantic by a crew of Navy Department aeronauts. Construction of the airship will be under the direction of a staff of American navy experts.

The German L-70 class of airship measured 743 feet in length, 48 feet longer than the British ZR-2, but having the standard German diameter of 78,4 feet. Their total useful load was more than 88,000 pounds, equivalent to 59 per cent of the total weight of these ships. The ships carried by a crew of thirty men each. They were driven by seven Mayback engines of 290 horse power each, arranged in six power cars suspended below the belly of the ship, two being placed in the after car, giving a total horse power of 2,030, and developing a speed of over 80 miles an hour.

Announcement that the Government had obtained permission to construct a rigid airship in Germany was followed by the disclosure that two German aircraft engineers visited this country several months ago to study possibilities of a fast Zeppelin service between Germany, New York and Chicago.

The engineers were said to represent the Zeppelin Airship Building Company of Friedrichshafen and gave their names as Harry Vissering and E. A. Lehman. They were in frequent conference with Weather Bureau officials. It is learned that they discussed plans for a passenger and mail carrying fleet of Zeppelins to ply between Germany and America.

Admiral Moffatt Endorses Aviation Bill

Washington.—Legislation now before Congress for the establishment of a Bureau of Civilian Aeronautics under the jurisdiction of the Department of Commerce received the endorsement of Rear Admiral William A. Moffatt, Chief of the Bureau of Aeronautics of the Navy Department, who had a conference with President Harding, Dec. 14.

Admiral Moffat's appointment with the President was the result of a conversation he had with Mr. Harding when the latter attended the manoeuvers of the Marine Corps over the Wilderness battleground in Virginia last Fall, when the President intimated that he would like to hear further the Admiral's views on aviation questions.

It is the apparent view of army and navy aviation experts that commercial aviation must be developed by government agencies outside the War and Navy Departments, and that civilian aviation should be encouraged as an potential auxiliary to the naval and military flying forces in time of war. At present the only Federal encouragement to aircraft manufacture has come from the army and navy experimentors and obviously this does not furnish sufficient business to warrant serious investment in aeroplane factories.

Urges Roma Be Sent to Mitchel Field

Major W. R. Weaver, commandant at the Mitchel Aviation Field, near Mineola, is trying to induce the War Department to send the dirigible Roma, recently purchased from the Italian Government, on a flight from Washington to and over New York city. He has written to the department asking for an appropriation to construct an airship mooring at Mitchel Field.

Major Weaver said that he has asked for $1,000, and that if he succeeds in getting the money he will then urge the War Department to send the Roma here. The concrete work of the mooring alone, he said, would be about $650.

Mitchel Field is soon to become the center of air service activities in the East. The personnel of the field is to be increased and soon eight air units will be established there.

Deliver Seaplane Carrier.

The Todd Shipyards Corporation has turned over to the United States Navy the U. S. S. Wright which has been converted into a balloon and seaplane mother ship in the Tietjen and Lang Shipyard, Hoboken. The vessel is named in memory of Wilbur Wright.

The Wright was originally built for the transport service and the alterations include space for the stowage of six kite balloons, a plant for generating hydrogen and repair plants for balloons and seaplanes. The vessel will carry spare wings and other parts and will also be equipped with a pigeon coop, aerological laboratory and a complete photographic laboratory. She will be armed with four five-inch guns and two machine guns.

The Wright is 448 feet long, 58 feet beam and 31 feet depth and of 14,240 tons displacement. She will have a cruising speed of 15 knots.

Eighteen Years of Flight

Eighteen years ago, December 17, the world's first aeroplane flight was made by Orville Wright at Kitty Hawk, N. C. In a crude, insecure biplane, Wright attained a speed of thirty miles an hour, the duration of his flight being fifty-nine seconds. Since then the progress of aviation, aided by the war impetus, has been so rapid that now continuous flights of more than twenty-four hours and speed of more than 175 miles an hour are common.

In his first statement since the war, issued from the office of the Aeronautical Chamber of Commerce, 501 Fifth Avenue, Mr. Wright recalls his first effort at flying.

"Just eighteen years ago, on December 17, 1903, after centuries of endeavor, man for the first time was lifted into the air by a power propelled aeroplane," Mr. Wright says. "Flight seems so easy today that one naturally wonders at the long delay in its accomplishment. Yet eighteen years ago, on account of the thousands of failures, flying was classed with perpetual motion and the few who expressed belief in its possibilities were looked upon as mentally unbalanced. Up to 1900, only a few measurements of aeroplane wings had been made along successful lines. Most flying experiments up to that time had been made on the 'cut and try' plan; and by that plan flight probably would not have been accomplished for centuries yet to come.

"The problem was not one to be solved by guesswork. Duechemin, about the middle of the last century, had published a formula for calculating the pressure on planes at different angles. Lillienthal, in the eighties, had published his measurements on several curved surfaces, with other valuable scientific work. Langley, in the nineties, published his measurements of plane surfaces, corroborating the earlier work of Duechemin. It was to the work of Lillienthal that my brother and I were by far most deeply indebted. But owing to various defects in the systems of measuring all of this work, we found it too inaccurate and too meagre for purposes of design.

"In 1901, my brother Wilbur and I having proved by actual gliding tests the inaccuracy of these tables, began a scientific study of the subject. We designed new types of measuring instruments and made measurements of hundreds of differing wing surfaces in a wind tunnel. It was due to the accuracy of these measurements that we were able, in 1903, to design a new type of biplane, almost entirely from calculation, which was able to lift itself and operate into the air with a crude motor weighing more than twelve pounds per horsepower. We had already developed a new system of control, the system with which our name has been so largely connected, but this system of control would have been of little use without our wind tunnel work, which enabled us to design a machine which would lift itself."

Mr. Wright, in a prophetic vein, wonders what another eighteen years of progress will develop in aeronautics. He believes that aeroplane is still in its infancy and that the use of the aeroplane as a carrier will be universal.

Personal Pars

Major W. R. Weaver has been ordered to assume command at Mitchel Field.

Lieut. T. J. Koenig has been ordered to duty in the office of the Chief of the Air Service.

FOREIGN NEWS

French Aerial Lighthouse

From France it is reported that the French Air Ministry has recently acquired a new aerial lighthouse which is said to eclipse entirely anything that has hitherto been attempted in the way of lighting up the air routes. The new lighthouse, which, it is stated, is to be erected on Mt. Africa, near Dijon, at an altitude of 1500 feet above sea level, will throw a light which, in clear weather, it is expected will be visible for a distance of 200 miles.

Activity in Mexico

According to the November 28th issue of Commerce Reports, issued by the United States Department of Commerce, commercial aviation in Mexico is rapidly expanding, and thus giving proof of the increasing importance of this branch of the automotive industries. The Secretary of Communications of Mexico, according to El Campo of September, 1921, has made arrangements with a foreign company with a view to establishing an aerial transportation service for passengers and cargo between Mexico City and Tampico. The operating company made the first trip with passengers, mail, and cargo on September 1, taking two-and-a-half hours from Mexico City to Vera Cruz and one hour from Vera Cruz to Tampico. When the shipment of the fifteen machines arrives, the services will be extended to include San Luis Potosi, Monterey, Laredo, and Matamoros. A special service will be established between Tampico and Laredo.

A commercial aerial service between Juarez City and the City of Chihuahua is definitely planned. The distance between the two points is approximately 360 kilometres, and the journey takes 10 hours by rail and 12 hours by automobile. The aeroplanes, which will be piloted by American aviators, are expected to make the journey in less than two hours. Special flights are planned to mining camps and other nearby places, with the consent of the mine owners. The landing fields in Juarez City have been chosen, and permission has been obtained from the authorities of El Paso to use the field of Fort Bliss, near the frontier, for landing purposes.

The Pescara Helicopter

In the course of trials carried out at Barcelona, the helicopter invented by the Spanish engineer, Senor Pescara, rose one meter from the ground; the inventor then demonstrated that the machine could tilt either backwards or forwards, and turn in a circle. These trials were carried out in a garden sixteen metres long and ten metres wide, while a wind of thirty kilometres an hour was blowing. No cables or gas balloons were used as supports. Senor Pescara will continue his experiments in France. He intends shortly to bring his machine to the Villacoublay Aerodrome.

Ocean Airships

The following interesting article by Major C. C. Turner was published by the London Observer:

Before the end of 1923 at least one regular airship line between South America and the Old World will be in operation, and the east coast of Latin-America, with its great cities of Buenos Aires, Rio Janeiro, and Pernambuco, will be separated from London by no more than five days. All parts of South America—even those not directly on the air routes—will be brought nearer; and the West Indies will certainly by that time have flying-boat services with connections to the airship lines. It is highly probable, too, that by the end of 1923 New York and London will be served by a line of airships. The first great step in the establishment of trans-ocean air services is, however, due to Spanish-German enterprise, to the co-operation of German airship experts with the Spanish shipping company, the Compañia Transatlantica, with a view to services between Cadiz and Buenos Aires.

German airship engineers have for some time been in Spain, and the Spanish Government deputed Major Herrera to confer with them. The head of the German party is Herr Hugo Eckener, formerly associated with Count Zeppelin. The Commission has chosen an airship site between Seville and Cadiz; and Major Herrera and two other Spanish experts, with two Germans, paid a visit to Argentina with the object of choosing sites, studying the conditions, and obtaining financial support from the Argentine Government. They have reported to the effect that it will be necessary to use larger airships than any yet constructed (with the exception of R38), and that the weather on the European side is favorable, but that on the American side it would be necessary to have a revolving shed. Seven German airship sheds were allocated to France, and if the French Council of National Defence is able to persuade the Government to agree to the Air Department's airship program these sheds will be re-erected at Marseilles, Paris, Tunis, Casablanca, Algiers, and Dakar (Senegal).

Paris (Orly) will be the principal French airship base; and, indeed, the installations necessary for carrying on construction are already in an advanced stage. They include big gas-holders, airship sheds and workshops, and a Customs house. Mooring masts definitely appear in the French programme.

The French Government cut down the airship program in this year's Budget Bill, and it is quite on the cards it may do so again. But the circumstances have changed materially; France cannot ignore the prospect of German airship construction and operation being maintained.

In examining the map of the Atlantic the climatic conditions should be considered. The route from Bathurst or Dakar to Pernambuco takes in the region of the South-East trades, and traveling either way airships would have these winds more or less abeam, this reducing their net speed. North of that region there is a large area of calm or variable wind; and north of this, again, the westerly winds of the North Atlantic prevail, a factor seriously to be reckoned with in any project for an air service between New York and Great Britain. This region begins about the parallel on which New York and Gibraltar are situated. Airships from Spain to Pernambuco would have a helping wind usually as far as the Cape Verde Islands, but would on the return journey over this section have to make headway against the wind. The coasts of Africa and South America are subject to monsoon seasons.

So far as Great Britain is concerned, airship affairs are at a standstill, and unless the Imperial air routes scheme is adopted, a complete abandonment of commercial airship development can only be averted by some private concern stepping into the breach. Nevertheless, in view of German and French activities, it is quite obvious that British neglect can only be of a temporary character. Sooner or later we must resume operations; although, by allowing things to drift, by abandoning construction, and permitting the dispersal of the technical, constructional, and operational staffs, we must eventually incur the utmost possible expense.

The British New Subsidy

It is rumored that a new sum has been allocated for next year's subsidy, and this will be allotted as follows:

To the gross takings, a sum equal to 25 per cent. of these will be added.

To each passenger's fare £3 will be added from the subsidy, and 3d. to each pound of goods.

That is to say, for each £6 passenger the air lines will get £3 net added, and a further £1 10s. as 25 per cent. of the gross takings, which means £10 10s. per passenger.

If the air lines cannot make themselves pay at that rate, then obviously civil aviation is a failure or else it is time that somebody with great business acumen took the business in hand.

The Fokker Incident

The matter of the Fokker exhibit at the Paris Aero Show has now become the subject of diplomatic representations.

It appears that the Fokker monoplane at the Grand Palais has been seized by the French Legal Authorities upon the representation of M. Robert Esnault Pelterie, who alleges it to embody an infringement of his control-lever patents. In consequence the Dutch Government, at the request of Mynheer Fokker, is reported to have made representations to the French Legation in Holland.

It is very difficult to believe that such an action as this could have occurred in any civilized country as the result of foreign participation in an exhibition alleged to be "International." But success in war has always produced among the Latin races a complete breakdown of that courtesy for which they are distinguished in their periods of humility.

Suspension of London-Amsterdam Air Service

The Postmaster-General announced that on and from November 19 the air mail service between London and Amsterdam has been suspended.

Death of Alfred Leblanc

It is with the greatest regret that we have to record the death, at the age of 51, in Paris, after a long illness, of the famous French pilot Alfred Leblanc. One of the very first French pilots, Leblanc was taught to fly by Louis Blériot, with whom he worked for a number of years. He was the winner of the famous Circuit de l'Est, and represented France in the earlier Gordon Bennett Races. For his distinguished services he was awarded the Cross of the Legion of Honour.

(*Concluded from page* 370)

Flat plate method. This method only differs in its results from the reflection method at angles approaching maximum lift for the Martin and the U. S. A. 27 and somewhat higher angles for the R. A. F. 15 Special. Above these angles the lift drops off abruptly and it is evident that the trailing edge has entered the region of slower moving air surrounding the flat plate. It will be noted that the redundant type of air flow found in the reflection method at high angles introduces less inaccuracy than is found here.

In *The Ace,* for December, 1920, an account is given of a test by Mr. A. A. Merrill, of the California Institute of Technology, of ground influence on a biplane model at the single angle of incidence of 13°. In an aeronautical report, No. 173, of the Construction Department, Navy Yard, Washington, D. C., dated February, 1921, are charts of a test made on an R. A. F. 6 aerofoil with the ground at various distances. In both of these tests, the flat plate method was employed. The results are in consonance with the work done with a flat plate in the present tests. In the tests on the R. A. F. 6 a decrease in lift at high angles was found. This report did not come to hand until the present tests were completed.*

Ground effect is not entirely beneficial. It decreases the landing speed and cushions the landing shock somewhat, but does so at the expense of an increased length of preliminary skimming over the ground. By decreasing the drag and increasing the lift it lengthens the distance necessary for the aeroplane to travel before losing enough speed to land.

On the other hand, its influence is helpful in taking off, especially in the case of flying boats with their low-lying wings. It points to the fact that the closer the wings are to the ground the easier it is to pick up speed. It promises economy for low-skimming flight over smooth water, provided such flight be practicable.

In the conventional tractor aeroplane, the height of the wings above the ground is determined largely by propeller clearance, but a small low-speed aeroplane like the Pischoff and large low-speed commercial aeroplanes with engines between wings can utilize ground influence to good advantage.

* In Fig. 5 three curves from the W. N. Y. tests are reproduced for comparison.



The Requirements of Aeroplane Engine Design

(*Concluded from page 329—Dec. 12*)

PERHAPS the most common cause of engine failure is faulty lubrication. Any failing in this direction is felt immediately by an engine working under the severe conditions of loading which obtain in aero practice.

Failures are commonly caused by dirty oil, which causes choking of the smaller oilways and thus cuts off the parts fed by them from any oil supply. Oil should always be filtered and the oiling system should always be flushed periodically. Indirectly the oiling system is affected by excessive wear, inasmuch as the oil escapes so readily from the worn bearings that others, less worn, do not get an adequate supply.

Ignition systems cause a certain amount of trouble. On most larger engines, however, the ignition is usually duplicated and complete failure therefore seldom occurs. Dirt, moisture and oil are the most frequent causes of trouble. Ignition troubles due to oiling are the most prevalent in the case of rotary engines because of the large amount of oil consumed. If the plugs are cleaned often and tested, and the distributors and contact breakers are kept clean, little trouble is experienced. The effects of moisture are usually only met with after an engine has been laid up for some time.

A third common form of trouble is carburetion, which, again, is nearly always caused by dirt or water. This, however, should seldom be met with if all the gasoline is passed through chamois leather before being put into the tanks.

Mechanical breakages, unless they be the result of oiling troubles, usually occur amongst the smaller parts of the engine, such as valves and their details. They may be the result of faulty material or design, and can be guarded against only by constant inspection.

Reliability and simplicity are very nearly related. Every additional part of an engine provides another possible source of breakdown. Furthermore, the more complicated an engine is, the more difficult it is to examine and clean. It is during the routine cleaning and examination that the distortion of parts, the wear, the loose nuts, and other common causes of failure are discovered. Some engines are so complicated that the exposure of parts which should be the subject of frequent examination is a matter of quite some difficulty. Consequently they rarely receive the attention they should. The moving parts, such as valve operating gear, etc., should, where possible, be enclosed in oil-tight casings, allowing for their adequate lubrication and at the same time giving the engine a clean external appearance. They should, however, be readily accessible.

Accessibility is always a difficult problem to the designer, as he has so many things to fit into the space available. The following parts, in the order named, should always be easy to get at: spark plugs, carburetor jets and filters, magneto contact breakers and distributors, oil filters, valve tappet adjustment, switch wiring, and control levers.

In the foregoing discussion the question of cleanliness has, perhaps, been somewhat elaborated, but it is of extreme importance. There is, however, another matter which exerts almost as great an influence on reliability, and that is the pilot's attitude toward his engine. The pilot who feels for his engine, runs it up carefully, never overloads it unnecessarily, and, when it is not working its best, nurses it, is very seldom faced with serious engine trouble.

Smooth running is essential. All vibration and roughness mean excessive wear somewhere and consequently affect the reliability adversely.

Compactness of design is essential. The space available for the engine is very limited. Low cross-sectional area in the direction of flight is important, especially in the case of machines where the engine is not built into the fuselage.

Many of the early types of engines were prone to catch fire. The chief cause of fire in engines is back-firing in the carburetor. A broken valve, or too weak a mixture (which commonly results from dirt or water in the jets), may cause a backfire. This may ignite the gasoline in the mixture chamber. For this reason the carburetor intakes should be carried clear of anything inflammable. Gasoline pipes liable to breakage should also be kept as clear of the carburetor intakes or exhaust outlets as is possible. Carburetor fires are usually quickly extinguished by being sucked through the engine. In the event of an engine fire, the last thing the pilot should do is turn the ignition switch off. The correct procedure is to turn off the gasoline and open the throttle, thus sucking the carburetors dry and also preventing the fire from being supplied with gasoline if one of the pipes has cracked or burned.

Oil and gasoline economy, apart from weight considerations, are of considerable importance in the commercial aeroplane. These items will constitute a large proportion of the running expenses. The vertical engine with large cylinders is at present the most economical. Fuel economy depends on the compression ratio, a high compression being most economical. With the present system of induction, the power of the engine falls off very greatly when the machine is flying at high altitude. Systems of forced induction promise considerable improvement, both in power and economy at varying heights.

The cost of aeroplane engines is a matter of quantity production. It need not be high. The war has provided sufficient data for standardization. The aeroplane designer need have little difficulty in selecting a suitable engine. Whatever machine it is for, proved reliability is the first essential. This taken for granted, a commercial balance, taking into consideration weight per horsepower, economy of running, and overhaul, and prime cost will have to be established.

Conservatism will always have to be reckoned with. Before any new engine is readily accepted by pilots, very complete proof of its reliability will have to be forthcoming. The comfort of having an engine with a reputation for never failing is inestimable.

Capitol Model Aero Club Activities

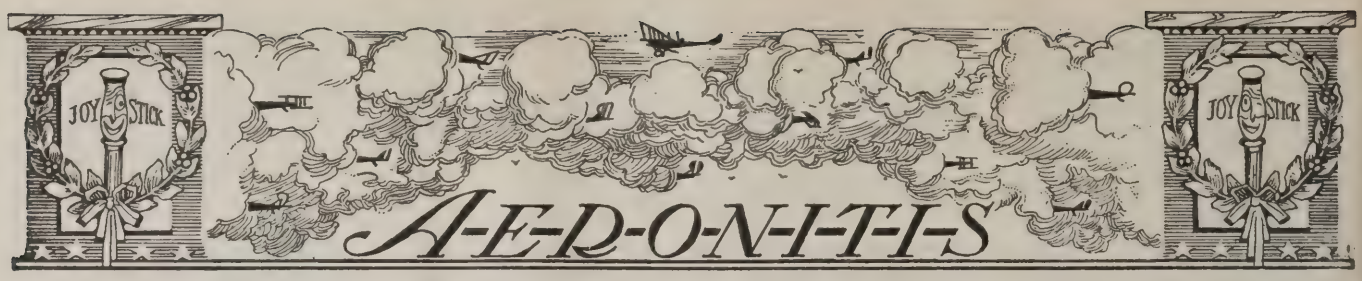
The Capitol Model Aero Club of Washington, D. C., is holding its meetings bi-weekly throughout the early winter months, and a keen interest in junior aviation is being manifested throughout that city. The members are decorating their new club room with photographs of aeroplanes and trophies of flying which the Air Service flying field has kindly loaned to them and a remarkable aerial atmosphere is apparent from the surroundings.

The Club is developing a supply base of its own, which caters to the needs of the members. The officers are designing a standardized racer which is expected to be the last word in efficiency as well as ease of production. New members are constantly coming in. The Club would be glad to communicate with all enthusiasts, and requests that mail be addressed in care of the President, Paul Edward Garber, at 1210 18th Street, N. W.

Junior Club of Aeronautics Organized

A group of young men of Kansas City, Missouri, have organized the "Junior Club of Aeronautics," of which the officers are Fred Hattoom, President, and C. H. Smitherman, Secretary and Treasurer.

Mr. Hattoom has recently completed a scale model of the Curtiss JN-4 with a span of 36 inches. All the measurements are as close to scale as possible in a model of this kind, some of the dimensions being scaled down from the real plane. The wings are covered and doped in the approved manner, giving a realistic effect to the model.



How It Feels

By L. L. De Jean

A friend of mine asked me one day:
"How does it feel to fly up high?"
I puzzled as to what I'd say,
And finally made this reply:
(P'r'aps it reveals.)

Have you e'er sailed upon the sea,
When it was rough, in a canoe?
Have you ne'er watched the bumblebee
From flow'r to flow'r his course pursue,
While sweets he steals?

Have you, in childhood days gone by,
Climbed up on top the barn to rob
A birdnest of its eggs, and spy
To see the pigeon feed the squab
Its wormy meals?

Have you gone coasting down a hill?
At sixty miles an hour or more?
Do you recall that breathless thrill,
As past all other sleds you tore,
'Mid joyous squeals?

Have you, sometimes, when fast asleep,
Gone floating thro' the atmosphere,
And dreamt you climbed in circles steep
Up to the stars, and felt no fear?
That's how it feels!

'Twas a cold November morning, and all the K-Dets were there,
And the crowd in front of the hangars looked on with many a stare;
The mechanics all were busy, like a flock of bees in a hive,
While Cowdrick was preparing for his famous hop in the S. E.-5.

"Will he get by with it?" someone asked. "Will he come safely down?"
"He may be able to do it," another said, "if he don't go 'round and 'round";
"All right, DeFord, pull the chocks, we'll take a chance with this bird."
So he giv'er the gun and left the ground and many groans were heard.

For most an hour he sailed the skies, each minute his confidence grew,
He figured he'd get by with it, it was wonderful the way he flew;
His time was up, so he headed in with a feeling glorious and grand,
And he was feeling rather cocky when he came in to land.

The ground was there to meet him as he approached with a lovely glide,
And he made a three-point landing, but the three was on one side;
When he scrambled out of the wreckage, he said he was glad to be alive,
And that he needed more D. H. time before tackling an S. E.-5.

Langley Field Times.

Unhappy Medium

Housekeeper: You've a big healthy man, why don't you work?

Tramp: Lady, I'll tell yer me trouble. I'm an unhappy medium.

Housekeeper: What do you mean?

Tramp: Well, I'm too light for heavy work and too heavy for light work.

Ad Valorem

She (pouting): You don't value my kisses as you used to.

He: Value them? Why, before we were married I used to expect a dozen in payment for a box of candy, and now I consider only one of them sufficient payment for a new dress.—*Boston Transcript.*

Chug-Hic-Chug

Smith: What makes Bill's Ford run so crookedly?

Jones: He put some alcohol in the radiator, and now it's a case of auto-intoxication.—*Gargoyle.*

"Why the bump on your head?"
"Oh, just a clubby party with the boys."

Irishman: That's a foine lookin' gown ye have.
Hostess (yawning): Decolleté.
Irishman: Sure, an' they call it naikid where oi come from.

Bloke: Who was that fellow you talked to so long on the corner?

Soak: He was my old barkeeper.

Bloke: What did he say?

Soak: He said, "No."—*Puppet.*

He: I suppose you dance.
She: Oh, yes. I love to (o).
He: Well, then, we'll love.—*Scalper.*

Jupiter and Near Beer

By Hugh Thomason

"Take away this watery near-beer!"
Said the king of gods and men;
"Never at Olympus' table
Let that truck be served again.

Ho, Lyacus, thou, the beery!
Quick invent some other drink;
Or, in a brace of shakes, thou standest
On Cocytus' sulphury brink!"

Terror shook the limbs of Bacchus,
Paly grew his pimpled nose,
And already in his rearward
Felt he Jove's tremendous toes;
When a bright idea struck him—
"Dash my thyrsus! I'm a stew
For you never were in Pedro—
That you know not old Home-Brew!"

"Bring it!" said the Cloud compeller;
And the wine-god brought the beer—
"Port and claret are like water
To the noble stuff that's here!"
And Saturnius drank and nodded,
Winking with his lighting eyes;
And amidst the constellations
Did the star of HOME BREW rise!"

"What's your idea of clean sport?"
"Swimming."—*Syracuse Oronge Peel.*

Great Developer

"Have you had much experience in a jazz orchestra?"
"Five years ago I was a physical weakling."
"Well?"
"Feel my muscles now!"—*Birmingham Age-Herald.*

Alimony

"I have just heard some good news."
"Is that so? What was it?"
"My wife got a divorce!"
"Did the judge give her any alimony?"
"I hope he did, I won't."—*Judge.*

Abie Ast—"You're ten minutes late."
She—"What of it?"
Abie—"What do you mean by keeping me standing here like a fool?"
She—"I can't help the way you stand."—*Far Seas.*

Feeling Foine

Flaherty: "Mr. Chairman, Oi move thot—"
Chairman: "The gentleman is out of order."
Flaherty: "Ye're a liar! Oi niver felt bether in me loife."
—*Boston Transcript.*

AIR LAIRD PLANES WICHITA KANSAS

The Laird Swallow

"America's First Commercial Airplane"

THE Swallow's carrying capacity—three passengers, baggage and full fuel load—is one of the reasons that it is fast becoming America's most popular commercial ship. Let us send you our booklet.



Now Priced at $4,500

E. M. LAIRD COMPANY

Manufacturers

WICHITA, KANSAS

General Sales Offices

2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.
2216 So. Michigan Ave., Chicago, Ill.

Please send me details of your new sales plan and copy of booklet.

Name .....

Address .....

.....

AA

(*Concluded from page* 373)

LAKE MINNEWANKA, ALBERTA, *commercial seaplane station.*—Situated 7 miles north-northwestward of Banff, Alberta, and 3 miles westward of Bankhead, Alberta. Latitude 51° 15′ N., longitude 115° 25′ W. Altitude 4,800 feet above sea level. Local magnetic variation 26° 00′ E. Maximum dimensions for landing—1,000 yards by 5 miles. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long (inside measurement). See Diagram of Markings, Ref. No. 28.

Telephone—Bankhead line, ring one long and two short. Water and fuel supply. Facilities for repairs—poor. No machine accommodation. Available communication to city of Banff—taxis and motor buses. God gravel road.

Licensee.—A. W. Faulkner, Box 84, Banff, Alberta.

LEASIDE, ONTARIO, *customs air harbor.*—(Latitude 43° 42′ N., longitude 79° 21′ W.) Situated on the northeastern edge of the city of Toronto, 6 miles northward of Lake Ontario. Altitude—426 feet above sea level. Local magnetic variation, 6° 40′ W. Dimensions—400 by 600 yards. Licensed for use by day only and marked with a square and circle inserted, divided in equal parts by a vertical line. See Diagram of Markings, Ref. No. 21.

Customs personnel on duty when notified at the collector of customs' office, Toronto, Ontario. Directional wind indicator on hangar. Telephone connection and water supply. There are facilities for repairs, fuel supply, machine accommodation and a handling party is stationed on the aerodrome.

Available communication to the city of Toronto—Motor bus and trolley at Yonge Street, 3½ miles westward of the aerodrome, one mile by road to Leaside Station. Good roads.

Licensee.—The Ericson Aircraft (Ltd.) 120 King Street East, Toronto, Ontario.

VICTORIA BEACH, MANITOBA, *commercial seaplane station.*—Situated at Victoria Harbor, Manitoba. Latitude 50° 42′ N., longitude 96° 33′ W. Altitude 715 feet above sea level. Local magnetic variation 11° 05′ E. Maximum dimensions for landing—over 800 yards. Licensed for use by day only and marked with an equilateral triangle, each side of which is 3 feet wide and 25 feet long. See Diagram of Markings, Ref. No. 28.

Telegraph and telegraphic address—Air Board Station, Victoria Beach, Manitoba. Water and fuel supply. Facilities for repair to F.3 and H.S.2.L. flying boats. Slipway for beaching flying boats. Available communication to town of Victoria Beach—Motor boat and good roads.

Licensee.—The Air Board, Ottawa, Ontario.

NIAGARA FALLS, ONTARIO, *commercial air harbor.*—Situated on the Niagara to Chippewa Boulevard, 2 miles southward of Niagara Falls, Ontario. Latitude 43° 04′ N., longitude 79° 05′ W. Altitude 550 feet above sea level. Local magnetic variation 6° 05′ W. Maximum dimensions for landing—400 yards east and west; 300 yards north and south. Licensed for use by day only and marked with a triangle divided by two lines forming a cross into four approximately equal parts. See Diagram of Markings, Ref. No. 24.

Water and fuel suply. Facilities for running repairs only. No hangar accommodations. Available communication to Niagara Falls—motor transport, good roads.

Licensee.—Niagara Air Service, 618 Dominion Bank Building, Toronto, Ontario.

SASKATOON, SASKATCHEWAN, *commercial air harbor.*—Situated 3 miles northwest of City Hall, Saskatoon. Latitude 52° 10′ N., longitude 106° 43′ W. Altitude 1,650 feet above sea level. Local magnetic variation 23° 05′ E. Maximum dimensions for landing—300 by 400 yards. Licensed for use by day only and marked with a triangle equally divided by a vertical line. See Diagram of Markings, Ref. No. 26.

Water and fuel suply. Facilities for running repairs only. Accommodation for two machines. Available communication to city of Saskatoon—motor transport, good roads.

Licensee.—R. J. Groome, Box 285, Regina, Saskatchewan (Y.M.C.A., Saskatoon, Saskatchewan).

Dinner for Aviator Cooper

Merian C. Cooper, newspaper man, formerly a Captain in the American Air Service in France and later a Lieutenant Colonel of the Kosciusko Squadron of the Polish Army, was the guest of honor at the fourth annual dinner in the Hotel Gonfarone, New York City, of the Beaumont Club, composed of former members of the 200-201 Aero Squadrons, A. E. F.

Mr. Cooper is one of the two pilots in the service of the Polish Army who survived the experience of being brought down behind the Bolshevist lines, and it was with an account of his ten months' imprisonment in Russia and his escape last April to Riga that he entertained the guests.

MOTOR REBUILDING

CYLINDER GRINDING
ALUMINITE PISTONS
Iron Pistons, Piston Pins and Rings.

COMPLETE MOTORS

Parts for all airplanes and motors.
Finest equipment in U. S. for motor work.

GREEN ENGINEERING COMPANY
Dayton, Ohio
Main St., at Burns

TITANINE
TRADE MARK

DOPES AND COVERING MATERIALS

Can be obtained through

JOHNSON AIRPLANE & SUPPLY CO.		Dayton, O.
F. J. LOGAN	712 Superior W.	Cleveland, O.
N. STEELE		Denver, Colo.
F. C. AYARS	Box 294	Beaumont, Calif.
JAMES LEVY	2055 Indiana Ave.	Chicago, Ill.
DE LUXE AIR SERVICE		Asbury Park, N. J.

Made by
TITANINE, Inc., Union, Union County, N. J.

NOW AVAILABLE FOR YOUR AUTO
"The Plug That Cleans Itself"

Saves Gas **B-G** More Power

GUARANTEED CARBON AND OIL PROOF

Recognized as the best for aeroplanes, its success for automobiles is assured

B - G CORPORATION
33 Gold St., New York

If your dealer cannot supply you, send us his name and $1.00 for each plug, stating name and year of manufacture of your car.

FLYING SCHOOL
Our Graduates Are Satisfied
YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

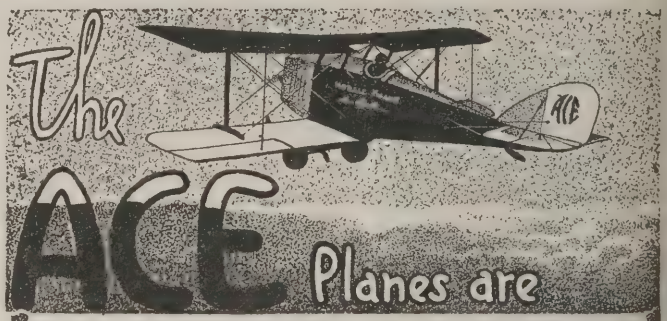
PHILADELPHIA AERO-SERVICE CORPORATION
636 Real Estate Trust Bldg. Philadelphia

L. P. WITHERUP
Mechanical Designing Engineer
Specialist on
Lubrication and Bearing Problems.
I Make Your Own Bearings or Bushings Work Without Heating.

DESIGNING, DEVELOPMENT, DETAILS, DELIVERY } of { Internal Combustion Engines of any type, class or service. Airplanes to Farm Engines. Invention Devices, Manufacturing, Air Compression, Pattern and Machine Work.

If you have a two-cycle engine giving you trouble or will not develop its full power, write me particulars and I will straighten it out.

LOCK BOX 1472, CINCINNATI, OHIO



Built for the man who loves the air regardless of the business that calls him.

AVIATION SCHOOLS!
Solo students on the ACE

HORACE KEANE
Aero Planes
Sales Office: 503 Fifth Ave., N. Y.
Factory: North Beach, Long Island

SPECIAL OFFER

New wheels with casing and tube
$12.00 comp. F. O. B. Buffalo

Canuck JN4 and 0X5

Spares and Supplies

Special prices from now until end of season. Act quick, don't wait until Spring to refit; use your spare time in the winter season.

Write us direct for quotations

ERICSON AIRCRAFT LIMITED
120 King Street E. Toronto, Canada

New Aeroplane Supply Sale

Acetate Dope Guaranteed 55 Gal. Drum and 50 Gal. Bbls. $1.00 per Gal. No charge for containers. 5 Gal. lots $2.25 per Gal.

Spar Varnish, 5 Gal. cans, $2.25 per Gal.

Green Brown Wing Enamel, 5 Gal. cans, $1.50 per Gal.

TYCOS ALTIMETERS, register 20,000 feet radius, $15.00 each.

New Leather Aviation Helmets, $5.00 each, cost $18.00.

½" Brass Gasoline Stop Valves, $6.00 per Doz.

AC Spark Plugs Metrics $3.00 per Doz. $20.00 per hundred. $180.00 per M.

4" Barrel Turnbuckles $3.00 per Doz. $15.00 per hundred.

Wicker Pilot Seats, $4.00 each, $36.00 per Doz.

Tufted Fabricoid covered cushions for above $1.25 each.

Size No. 2½ Tinned Tacks, 15c per lb.

MAX TOPPER & ROSENTHAL
11th Ave. & P.R.R. Tracks Columbus, Ohio

UNIVERSITY OF ILLINOIS LIBRARY
JAN 3 1922

AERIAL AGE WEEKLY

VOL. 14. No. 17 JANUARY 2, 1922 10 CENTS A COPY



The Lincoln Park Yacht Harbor of the Chicago Yacht Club, Photographed by Whitney Speer & Co.

Aeronautical Chamber of Commerce Organized

Review of American Aviation for 1921

Curtiss Wins Hydroaeroplane Suit

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
criptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



FULL-SIZED PROPELLER AND TWO YEARS OF AERIAL AGE FOR $10.00

THROUGH an arrangement which we have consummated with the organization that purchased large quantities of Air Service Propellers, we are enabled to present an opportunity to every reader of Aerial Age to secure a full size aeroplane propeller—an admirable souvenir that every aeronautic enthusiast will want to secure. Some of the uses to which these propellers may be put are indicated on this page. They originally cost from $85 to $150 each, and are now obtainable, together with a subscription to *Aerial Age*, for a ridiculously small price.

To each person sending us a subscription for two years (or two subscriptions for one year each) and enclosing their check for $10.00, we will send a two-bladed propeller, properly cased, freight charges to be paid on delivery by the addressee. If a four-bladed propeller is desired a check for $13.00 should be remitted for the subscriptions and propeller.

ORDER BLANK:

Please find check enclosed herewith for $....., for which enter subscriptions, and send propeller as per enclosed memorandum.

Name .....

Address .....

AERIAL AGE WEEKLY, 280 Madison Ave., New York City

January 2, 1922

AERIAL AGE WEEKLY

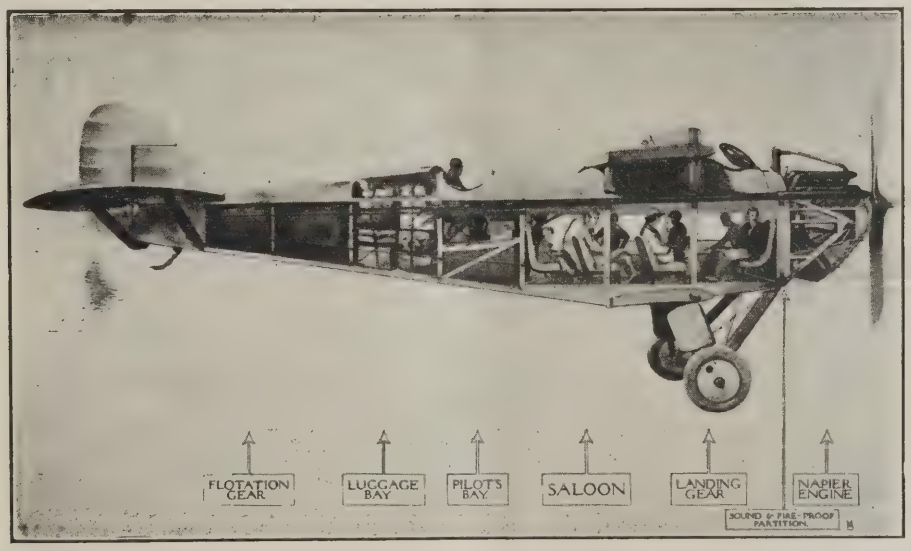
VOL. XIV, No. 17

TABLE OF CONTENTS

Review of American Aviation for 1921 387
The News of the Week..... 388
The Aircraft Trade Review..... 389
United States Court Decides Glenn H. Curtiss Invented Hydroaeroplane 390
Aircraft Industry Organizes Chamber of Commerce to Popularize Travel by Air 391
Standardization and Aerodynamics. 392
The Curtiss-Navy Racer 393
Aeronautic Lessons from Europe... 394
Aero Club of America Committees. 395
Supplementary Report on Experimental Reinforced Plywood Truss Ribs 395
Comparative Effect on Engine Operation in Flight of Outside and Inside Air Intakes 397
Aero Club of Pennsylvania 397
Naval and Military Aeronautics... 399
Foreign News 400
Elementary Aeronautics and Model Notes 401
Aeronitis 402

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

THE
DH18



The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

AMERADA ENGINEERING CORP. 505 FIFTH AVENUE NEW YORK CITY

Curtiss



WORLD'S RECORD

"CURTISS" NAVY RACER with "CURTISS" CD-12 MOTOR

AMERICAN LEGION CONVENTION, Kansas City
INTERNATIONAL AERO CONGRESS, Omaha
October 31st to November 5th, 1921.

"CURTISS" Firsts — LEGION JUNIOR DERBY—Casey Jones in "C-6 ORIOLE."
LEGION FREE-FOR-ALL—Lloyd Bertaud in "K-12 BALILLA."
PULITZER TROPHY RACE—Bert Acosta in "CURTISS NAVY RACER."
OMAHA 90-MILE RACE—Casey Jones in "C-6 ORIOLE."
OMAHA 75-MILE RACE—F. A. Donaldson in "OX-5 ORIOLE."

"CURTISS" Seconds—PULITZER TROPHY RACE—Clarence Coombs in "CURTISS COX RACER."
OMAHA 90-MILE RACE—N. C. Torstensen in "K-6 ORIOLE."
OMAHA 75-MILE RACE—Casey Jones in "OX-5 ORIOLE."

"CURTISS" Thirds — OMAHA 90-MILE RACE—R. S. Miller in "K-6 ORIOLE."

CURTISS AEROPLANE & MOTOR CORPORATION

GARDEN CITY LONG ISLAND, N. Y.

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., January 2, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, JANUARY 2, 1922 No. 17

REVIEW OF AMERICAN AVIATION FOR 1921

CIVILIAN flying in the United States increased 20 per cent in 1921 over the preceding year, according to a review compiled by the Aeronautical Chamber of Commerce for the Department of Commerce. Twelve hundred aircraft were operated by civilians during the last year, flying a total of more than 6,500,000 miles and carrying approximately 275,000 passengers. The figures are based on authenticated reports to the Aeronautical Chamber of Commerce from all sections of the country, and tend to prove that America is holding her own in the air as far as individual effort and accomplishment are concerned.

"In the last twelve months aviation has outgrown romance and is now recognized as practical art," says the review. "The year was crowded with important events, and Government, State, municipal officials and transportation experts are agreed that civilian aeronautics must be developed for peaceful transport and as a reserve arm of the national defense.

"The U. S. Air Mail Service in 1921 made such a record for efficiency on the transcontinental route that it is recognized as a model for civilian aerial transport the world over. Letters have been delivered in New York two days after casual mailing on the Pacific Coast. The service has an average of 88.82 per cent efficiency, that is, completed trips on scheduled time since it was started in May, 1918. The Air Mail has during the last year completed its wireless communications system, the fourteen stations now having radio plants, three operated by the Navy Department and the others by the Air Mail Service. Last February, a continuous flight, with night flying, was made between San Francisco and New York. Mail leaving the Coast at 4:50 p. m. Feb. 22nd, was delivered in New York at 4:50 p. m. Feb. 23rd. U. S. Mail and Curtiss planes delivered to the Coast photographs of the Carpentier-Dempsey fight within 48 hours after leaving.

"Governors of States and heads of Federal bureaus, realizing that fast transport depends upon proper terminal facilities, have started campaigns for the acquisition of municipal landing fields. Ordinances regulating aerial traffic have been passed and enforced in scores of municipalities. Almost all large cities have aerial traffic regulations. State legislatrues and municipalities in passing legislation have made it clear that local regulations are temporary and designed to be suspended by the national code when it is effected. The American Bar Association, Aero Club of America, Aeronautical Chamber of Commerce of America, Manufacturers Aircraft Association and the National Aircraft Underwriters Association, the Society of Automotive Engineers and the National Advisory Committee for Aeronautics have recognized the necessity for a national aerial code. Their views have found expression in the Wadsworth-Hicks Bill now before Congress providing for a Bureau of Civil Aviation in the Department of Commerce. This bureau, among other duties, will have supervision over the licensing and registration of all commercial aircraft and pilots and the enforcement of the laws.

"Among the world's records made during the year in America were those of Lt. J. A. Macready of the Army Air Service, who in September reached an altitude of more than 37,800 feet above Dayton, Ohio, parachute drops of from 22,000 to 25,000 feet made by Lt. A. G. Hamilton and Sergt. Encil Chambers, of the Army Air Service, the closed course speed record made by Bert Acosta in a Curtiss-Navy racer at the Pulitzer Race in Omaha in November when he covered a triangular course of 150 miles at a speed of 176.3 miles an hour—260 feet a second. The Loening Monoplane Flying Yacht carried four passengers to an altitude of 19,500 feet over Port Washington, L. I., in August. A Martin twin motored bomber attained a height of 25,600 feet at Dayton, O.

"Other spectacular performances included the transcontinental flight of Lt. W. D. Coney from San Diego, Cal., to Jacksonville, Fla., 2,180 miles in 22 hours and 27 minutes, the bringing of an army airplane to a dead stop within 15 feet after landing by means of the reversible propeller, the flight of the Aeromarine 'President Zayas' from New York to Havana in 19 hours' flying time, the 4,842 mile flight of the two U. S. Marine Corps planes in charge of Lt. Col. T. C. Turner, from Quantico, Va., to Santo Domingo and return, the 3,200 mile flight of the twelve Navy seaplanes from San Diego, Cal., to Panama. Then there was the feat, repeated four days, of the Army, Navy and Marine Corps planes which flew 100 miles out at sea and dropped tons of explosives on the surrendered German craft in the course of the aerial warfare demonstrations off the Virginia Capes last June and July, which proved conclusively the effectiveness of airplanes in coast defense against surface vessels.

"There were many other accomplishments, less spectacular, but no less important and significant of the rapid develop-

(*Concluded on page* 398)



THE NEWS OF THE WEEK



Experts Indorse Air Bureau Plan

Washington.—Little progress is being made in commercial aviation because there are no governmental agencies for its protection and encouragement, according to army and navy experts who appeared before the Senate Committee on Commerce Dec. 19. They favored the Wadsworth bill which proposes to create a Bureau of Civil Aviation in the Department of Commerce. It provides for the licensing of pilots, taking precautions against accidents, systematizing the flights of commercial planes and the establishment and supervision of routes and landing fields.

Major Gen. Mason Patrick, head of the Army Air Service, said the Wadsworth bill meets with the unqualified approval of his department.

"Should aircraft development reach the proportions the possibilities indicate," said Gen. Patrick, "it would provide the War Department with a trained personnel in case of an emergency, and the plants making the needed planes could be quickly converted into factories for the production of war planes in quantities."

In the opinion of Gen. Patrick, the industry will not assume any considerable proportions until some legislation similar to the pending measure is enacted.

"It will require large investmentts," he said, "and capitalists are shy about investing their money without proper safegaurds."

Replying to a question by Senator Jones of Washington, Gen. Patrick said he did not know of a large organization in New York which is planning to take up the business of commercial aviation next spring on a large scale providing necessary protective legislation is enacted.

Rear Admiral W. A. Moffett, Chief of the United States Navy Bureau of Aeronautics, also supported the proposed measure. He strongly declared his belief that commercial aviation has been given a serious setback because pilots are not licensed. He said they are permitted to carry passengers in obsolete planes, unfit for use, and are allowed to fly over crowds of people.

Plane Saves 12 Stranded

Miami, Fla.—After passing five days without food or water on a reef of the Bahama Islands, twelve men aboard the stranded British motorboat Priscilla have been rescued by a hydroaeroplane of the Aeromarine Airways Company, according to word received here Dec. 18.

Hunting by Aeroplane

Spokane.—The wilderness of central Idaho and its game birds are but three or four hours from Spokane, if you travel as did Del Larson, by aeroplane and automobile. Larson says he obtained the legal limit of blue grouse and was ready to return to Spokane within half a day after he left it. By the ordinary means of travel, meaning train and automobile, the journey alone occupies nearly all of one day.

The flight was made in an airship of the United States Aircraft Corporation, with Lieutenant Nick Mamer as pilot. Leaving Spokane early in the morning a few days ago, they reached Lewiston in time for breakfast. At Lewiston they took passage in an automobile, and were dropping birds by the middle of the forenoon. The following narrative of the adventure is given by Mr. Larson:

"The lieutenant's objective was the Lewiston-Clarkston tristate fair, where he was to do stunt flying, and mine was the forests where nothing broke the silence but the whirl of wings, the crack of gun and the exultant words of the hunters.

"The first grouse was killed soon after we passed Waha lake. From that point to where the road ends bird after bird was dropped. We experienced less trouble in seeing grouse than in finding them after they had been shot, such was the density of the forest.

"Shortly before we reached the end of the road at Zaza Mr. Small asked us not to lok around for a few minutes. When he told us to look we found before us a sight that took our breaths. We were on the edge of a cliff. Below us, thousands of feet, was the river, a powerful rolling stream, while about us was the roughest country I have ever seen. From our positions at the edge of the precipice we could see three states. Idaho, Washington and Oregon. The scenery was well worth the expense and time of a flight by air and another by car."

Early History

Geneva, N. Y.—Evidence that the art of flying was discovered before the days of Langley and the Wright Brothers has been unearthed by a student of Physics in Hobart College, doing research work in the Hobart College Library. In a newspaper of September 11, 1811, the following article was found:

"The art of rising and moving in the air by means of wings, continues to engage the attention of a number of persons in Germany. At Vienna, the watchmaker Degen, aided by a liberal subscription, is occupied in perfecting his discovery. He has recently taken several public flights in the Preter. At Berlin, Claudius, a wealthy manufacturer of oil cloth, is engaged in like pursuits; he rises in the air without difficulty and can move in a direct line, at the rate of four miles an hour, but his wings are unwieldy and he cannot turn around in them. At Ulm, a tailor named Berblinger, announced on the 24th day of April, that he had after great sacrifice of money, labor and time, invented a machine in which he would on the twelfth day rise in the air and fly 12 miles."

Missouri Landing Field

The Henderson-Mauldin Aero Service report the establishment of a landing field 1½ miles east of Fulton, Mo. The field is 2,600 feet long, north and south, and 2,000 feet wide, and is marked by a hangar with circles and wind bag. The field is level, sandy, hard, and dry, and covered with short grass; altitude 800 feet above sea level; prevailing winds north and south.

Obstructions consist of a row of trees along the north fence, scattered trees along the east side, low telephone wires along the south side, and fence and two trees on the west side. Oil and gas on the field; hangar space for two transient planes. Address Mr. Walter F. Henderson or Leslie W. Mauldin for further information.

CALENDAR OF COMING EVENTS
under sanction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe
Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

Ralph C. Diggins' Chicago Airmen Traveled 70,270 Miles in Year

The 1921 annual field report of James Curran, Chief Instructor of the Ralph C. Diggins School of Aeronautics, shows remarkable attainment for Chicago airmen. The annual report covers activities of the Diggins' flyers from April up to and as of the closing of business November 30th. The interesting figures show a total of 1,028 hours in the air, a total of 15,000 flights and landings, and nearly 100 students graduated and qualified as pilots during the year. This necessitated 750 hours instruction in the air. Mr. Diggins points out that this is probably a record for aerial instruction never before before accomplished by any school in America.

The cross-country flying included a record breaking trip from New York to Chicago with six passengers and express for Marshall Field & Company, and three other trips to New York and return. Other cross-country flights with the big passenger plane included Indianapolis, Lincoln, Nebr.; Des Moines, Ia.; Cleveland, Ohio. Smaller planes made cross-country flights to West Baden, Ind.; French Lick, Ind.; Louisville, Kentucky, and Des Moines, Ia.; New York, and North Platte, N. D.

It required 9-6 10 gallons of gasoline per hour for the operation of the Diggins' planes for the entire year. This average is arrived at by including all type planes flying under all conditions in the sum total before striking average, so a much lower average would probably be arrived at if individual performances were considered only. This unquestionably proves the economy of flying.

500 aerial photos were taken by the Aerial Photography Department of the Diggins' Aviation Company, most of which were taken in Chicago. However, the aerial mapping of this company included South Bend, Elgin, Aurora, West Baden, French Lick, Ind., and practically all of Chicago suburbs.

It will be remembered that the Diggins' Aviation Company started the year 1921 with practically a total loss by fire which necessitated the re-establishing of the School of Instruction and Transportation Company. Mr. Diggins points out that had he been more fortunate at the beginning of the season he would be telling a different story for this year's accomplishments. He also states that in the future those interested in aviation should stop dwelling on the possibilities of aviation, but rather dwell on the actualities and accomplishments of aviation, stating that during the entire three years establishment of his company, there has not been a single mishap or injury to passenger or student.

Seek Proof Whether Metals Ever Get Tired

The question, "Do metals get tired?" which has puzzled scientists for hundreds of years, is being studied here by a committee of the National Research Council, with the aid of the Board of Engineering Foundation. Scientists say that every once in a while a piece of tempered steel or stout forging will break down without apparent reason.

The solution of the question, engineers say, is awaited eagerly by American aviation experts in the hope of making military flying safe.

North Carolina Seaplane Stations

The following information concerning facilities for the operation of seaplanes at the below mentioned ports has been received from the commandant of the United States naval air station, Pensacola, Fla., under date of November 2, 1921:

SOUTHPORT.—Latitude 33° 55′ N., longitude 78° 01′ W.

Anchorage.—Good anchorage in depths of 2 to 25 feet. Beach is unsuitable in general for docking planes.

Supplies.—Gasoline may be conveniently obtained from a gas-filling station conspicuously located on the end of a dock. No aviation supplies are available.

Communication.—Telegraph.

MOREHEAD CITY.—Latitude 34° 43′ N., longitude 76° 43′ W.

Anchorage.—Ample anchorage in Bogue Sound with good holding ground; average depth of water about 6 feet. Shelter may be obtained from winds from all directions. The beach is generally suitable for docking seaplanes.

Supplies.—Gasoline may be conveniently obtained from a gas-filling station. Supplies are available.

Communications. — Telegraph — Navy radio station.

South Carolina Seaplane Stations

The following information concerning facilities for the operation of seaplanes at the port of Charleston has been received from the commandant of the United States naval air station, Pensacola, Fla., under date of November 2, 1921:

CHARLESTON.—Latitude 32° 48′ N., longitude 79° 55′ W.

Anchorage.—There is ample anchorage room in water varying in depth from a few feet to 40 feet; the beach in general is unsuitable for docking planes. Much drift wood is in the harbor and must be carefully avoided in landing.

Supplies.—Gasoline and oil may be obtained from the Standard Oil Docks across from the north end of Drum Island, or by arranging for boats to carry gas out in drums. The Standard Oil Dock is somewhat high and difficult to approach.

Communication.—Besides the telegraph, there is a commercial radio station in Charleston in addition to the radio station at the navy yard.

Florida Seaplane Stations

The following information concerning facilities for the operation of seaplanes at the below-mentioned ports has been received from the Commandant of the U. S. Naval Air Station, Pensacola, Fla., under date of November 2, 1921:

ST. PETERSBURG.—Latitude 27° 45′ N., longitude 82° 38′ W.

Anchorage.—There is ample water for anchorage of seaplanes ranging in depth from 1 foot up to 20 feet. Holding ground is good; beach not suitable for beaching planes. There is a sheltered inner harbor in the southern part of the town, but the channel leading to it is somewhat narrow for large seaplanes to maneuver under unfavorable conditions.

Supplies.—Gasoline and oil may be obtained from a wharf in the inner harbor from hose lines, also from the wharf in the outer harbor from tank wagons. There are two private seaplane hangars at St. Petersburg from which minor spare parts and repairs could probably be obtained

Communication.—Telegraph station and Navy Radio station.

MIAMI.—Latitude 25° 46′ N., longitude 80° 11′ W.

Anchorage.—Good anchorage in depths from 1 foot to 10 feet. A sheltered anchorage can be obtained in the Miami River. Several very shoal spots exist which must be avoided in taking off and landing.

Supplies.—Seaplanes may obtain gasoline and oil from a gasoline dock in the Miami River. The river is quite narrow and somewhat difficult to navigate by large planes in unfavorable winds. Several civilian aviators operate planes at Miami, and it is probable that minor parts and repairs could be obtained from them.

Communications.—Telegraph and Navy Radio station.

TITUSVILLE.—Latitude 28° 36′ N., longitude 80° 49′ W.

Anchorage.—Shore is unsuitable for beaching planes. Holding ground is good. There is no inner harbor in case of heavy weather, but a lee can be obtained for winds from any direction.

Supplies.—Gasoline and oil may be obtained from the gas-filling station conspicuously located at the end of a dock. The wharf is easily approached from all directions. No aviation supplies are available.

Communication.—Telegraph office open only during the day.

ST AUGUSTINE.—Latitude 29° 54′ N., longitude 81° 11′ W.

Anchorage.—Beach is unsuitable for docking. Good anchorage exists in sheltered waters with good holding ground.

Supplies.—Gasoline and oil may be obtained from boats. So far as is known no aviation supplies are obtainable.

Communication.—Telegraph.

FERNANDINA.—Latitude 30° 40′ N., longitude 81° 28′ W.

Anchorage.—No suitable beach for docking planes. Available anchorage space has a depth of 30 to 60 feet. Ample room for taking off in all directions may be had by taxi-ing a short distance.

Supplies.—There are two gas-filling docks from which gasoline and oil may be obtained. The directions of approach to the docks is limited and might cause embarrassment in unfavorable weather. No aviation supplies are available.

Communication.—Telegraph, not open after 6 p. m.

UNITED STATES COURT DECIDES GLENN H. CURTISS INVENTED HYDROAIRPLANE

THE United States Circuit Court of Appeals of the Second District on December 15, 1921, reversed the decision of the United States District Court of the Eastern District of New York and held that Glenn H. Curtiss was the first person to invent and operate a successful and practical hydroaeroplane or flying boat and has awarded him the broad patent thereon. The decision is final.

The decision is regarded as one of the most significant developments in aviation since the adjudication of the Wright patents, as it serves notice to the world that credit must go to the United States, not only for the first practical flights by machine-propelled aircraft from the ground and back to the ground, but from the water and back to the water, as well.

Justices Merrill Hough, Martin T. Manton and Julius M. Mayer were on the bench, Judge Hough writing the opinion. The decision was rendered specifically against patent No. 1,312,910, which was issued to Albert S. Janin, of Staten Island, on August 12th, 1919, and which has been the subject of controversy in the Patent Office and the courts since 1913.

After the Wright Brothers successfully demonstrated mechanical flight, the next obvious step in realizing full dominion of the air was to construct and operate an aeroplane capable of taking off from and alighting on the water. Glenn H. Curtiss had been working on this idea as far back as 1908. So, too, had individuals in Europe, the most prominent of whom was the Frenchman Fabre, who in 1910 succeeded in getting off the water with a "tripod" gear, but failed in landing, repeatedly wrecking his machine, including his final attempt. The court has held that Mr. Curtiss has been shown to have been the first man in the world to successfully arise from and alight upon the water. A situation of international importance is thus created.

Mr. Curtiss' work was carried on at his plant at Hammondsport, N. Y., as early as 1910, when preparing for the flight down the Hudson from Albany to New York, he had successfully alighted upon the water by means of pontoons attached to his landing gear. In the same year, 1910, he operated his first primitive canoe or boat-like structure of a hydroaeroplane on the surface of the water.

In 1911 he built and successfully operated the world's first flying boat. On January 24th, 25th, and 26th, 1911, in the San Diego, Calif., harbor, he took off from and alighted on the water. His flights on January 26th were publicly announced and witnessed by newspaper men and recorded in the press.

On August 22nd, 1911, Mr. Curtiss filed application for a patent on the boat hull structure which has since been demonstrated and is now legally and finally recognized as the basis of all subsequent marine flying developments throughout the world.

On January 26th, 1911, the very day that Mr. Curtiss' flights were being publicly observed in San Diego, Albert S. Janin filed application for a so-called land, water, and air machine.

On July 31st, 1913, Janin filed a subsequent application substituting for the previous application, but retaining the date of the first. It was alleged that new and different drawings were offered which rendered the first application inoperative. It was further alleged that the last application concealed features upon which the first claim was based.

When Mr. Curtiss made application on August 22nd, 1911, interference was declared with the prior application of Mr. Janin, but the Examiner decided in favor of Mr. Curtiss. The Board of Examiners in Chief reversed the ruling in favor of Janin and the Commissioner of Patents in turn reversed it in favor of Curtiss. Janin carried the case to the Court of Appeals, of the District of Columbia, and won the decision by a majority of the court, after which Janin's patent was issued.

Mr. Curtiss then took the fight into the U. S. District Court to compel the Commissioner of Patents to grant him a patent for the invention. Judge Chatfield in 1919 dismissed the bill, holding that Janin was entitled to the invention.

Another appeal was taken by Mr. Curtiss to the United States Circuit Court of Appeals of the Second District, and the District Court was reversed.

Judge Hough in his decision, declares the fundamental point to be whether Janin, in his original application, of January 26th, 1911, disclosed an operative hydroaeroplane or flying boat and then answered this in the negative. "Decision both in the District Court of Appeals and the Lower Court," reads the decision, "has rested on Janin's 'unchallenged reduction to practice of January 26th, 1911.' It seems to have gone unchallenged in the interference, argument was rested on Curtiss' earlier achievements in 1910; in this case it is successfully challenged, and we find that Janin reduced nothing to practice, because what he conceived and disclosed is, as an hydroaeroplane, wholly inoperative, for it can not get out of the water;——the rest is immaterial. Decision is grounded on this point; though we may say further, that in view of the proven unreliability of Janin and his witnesses, we think no reduction or conception can be assigned him earlier than January 26th, 1911, in which case Curtiss antedated him by at least two days."

One of the interesting features of the evidence produced at the trial was a sketch presented by Janin and claimed by him to have been made in 1899 when he was a carpenter lad of 19. This sketch illustrated a hydroaeroplane having many modern features, including the now famous Wright invention on the ailerons and the Joy-Stick control and other modern features invented years afterward by famous aeronautical engineers.

Mr. C. M. Keys, President of the Curtiss Aeroplane & Motor Corporation, made the following statement:

"The decision in the Janin case is no surprise to me. The Board of Directors ordered the appeal to be made only after a thorough study of the evidence had made it quite clear that the rights to this invention lay with Curtiss. We are of course, gratified that the court has sustained that opinion.

"It is timely perhaps to state at this time the policy of the Curtiss Company with respect to the patents which it owns. The company in the past has had a definite policy to use its patents only as a manufacturing company, and has, perhaps, paid too little attention to the general use of these patents by others. The plane patents are, of course, made available to the major part of the industry as a whole under a cross license agreement which grants the right to use these patents to all members of the Manufacturers Aircraft Association on the payment of a fixed royalty for these patents, as well as the patents owned by others. The Curtiss Company owns, in all, some 200 patents covering both planes and motors. A few of them are, if they are sound patents, basic in their character; others are controlling patents in tht manufacture of planes and motors as at present carried on; while still others are detail patents of some importance; and many, as is natural in a new industry, cover details of design and practice which have already become obsolete.

"Full study of these patents has been going on since September, 1920. This survey began because it was seriously intended to liquidate the Curtiss Company in case it was impossible to obtain relief from some of the burdens imposed upon the company during the war, as a result of the war. It is necessary therefore to know pretty definitely what a trustee for these patents in liquidation might reasonably hope to find them worth. As a result of this survey, we know pretty definitely what we have.

"A thoroughly definite policy has been laid down by the Board of Directors with respect to these patents. When competent engineers and counsel tell the company that certain specific patents are worth protecting, they must be protected, just as any other property belonging to the stockholders of the company is protected.

"In establishing this policy, however, the company has in mind that it will, unless its rights are flagrantly invaded, make every effort not to interfere with the carrying on of experimental and research work in the aeronautical art. In this respect the policy of the company is identical with the policy of Glenn H. Curtiss before the company was organized and has been the policy of the company since its organization.

"We also must recognize that a somewhat free and casual use of other people's patents is natural enough in a new art. I do not believe that there is any widespread conscious intent in the aeronautical industry to appreciate without payment a property belonging to other people.

"We do not intend any wholesale litigation, but we are quite willing, should it be necessary, to test in the courts some of the more important Curtiss patents."

The particular claim that was framed by the Examiner in the Patent Office as the basis for the interference between Janin and Curtiss to determine the question of priority between them, is as follows:

"A hydro-aero-machine comprising a main aeroplane supporting surface, lateral stabilizing aeroplane surfaces to create a difference of lift, a main water-borne central boat structure adapted to support the entire machine when on the water, and except for the aeroplane lift, constituting substantially the

entire supporting element at all speeds so long as the boat structure is traveling in contact with the water, relatively small horizontal water balancing floats located below the supporting plane and beyond each side of said boat structure, said floats being located above the level of the boat bottom and provided with surfaces inclined downwardly and rearwardly, adapted to be acted upon by the rush of water when the machine loses its lateral equilibrium, and means for operating the stabilizing surfaces to create a difference of air lift."

There are, however, many other claims that have been made, and that have been allowed, and which will now go to Curtiss. Some of these claims, for example, are as follows:

"A heavier-than-air flying machine having an aeroplane, and a water-borne structure adapted except for the aeroplane lift to be substantially the entire supporting element of the machine at all speeds on the water, said machine having in the direction of each lateral end thereof a surface extending toward the water and adapted to be acted upon by the rush of water as the machine loses its lateral equilibrium.

"A hydro-aero-machine having a main aeroplane supporting surface, a water-borne central boat structure adapted to support the entire machine when on the water, and except for the aeroplane lift, constituting substantially the entire supporting element at all speeds so long as the boat structure is traveling in contact with the water, and lateral water stabilizing surfaces to create a difference of lift.

'In the machine adapted to be supported jointly by air and water while running on the water, an aeroplane adapted to be acted on by the air to exert a lifting effect, a centrally positioned floating means below the aeroplane adapted to support substantially the whole machine when at rest on the water and, except for the lift of said aeroplane, constituting substantially the entire supporting element so long as the machine is traveling in contact with the water, a relatively small float provided with a hydro-surface positioned in the direction of the lateral end of the aeroplane, and adapted to automatically balance the machine when either side becomes depressed.

"In a machine of the character described, an aeroplane adapted to support the whole machine in the air, lateral stabilizing surfaces to create a difference of air lift, a buoyant structure adapted to support the entire machine when at rest on the water and except for the lift of said aeroplane constituting substantially the sole supporting element so long as said machine is traveling in contact with the water, said buoyant structure having an upwardly inclined forward hydro-surface acted on by the rush of water and a substantially flat bottom, said aeroplane being so attached to said buoyant structure that when it is speeding in contact with the water said aeroplane is maintained at substantially a flying angle of incidence, whereby the machine rises to the top of the water and the head resistance of the water is decreased, and a propeller operating on the air to drive the whole machine forward until the air lift on said aeroplane raises the machine out of the water."

It will be observed that the last claim, which is one of the claims previously granted to Janin, brings in specifically the shape of the boat bottom in the operation of the machine on the water, but makes no reference to maintaining the lateral balance by the lateral water-acting floats.

"A heavier-than-air flying machine having an aeroplane a main water-borne structure adapted to travel in contact with and be supported by the water and constituting substantially the entire supporting element when the machine is speeding in contact with the water, an inclined hydro-surface toward each lateral end of the aeroplane and acted on by the rush of water, said aeroplane having a movable surface at each side under control of the operator to create a difference of air lift whereby the operator may depress either side of the machine when traveling in contact with the water and thereby force the hydro-surface on that side deeper into the water to create a drag on that side of the machine to aid in steering the same and correspondingly raise the hydro-surface on the elevated side so that it is substantially out of the water before the wing tip on the depressed side comes in contact with the water.

"A heavier-than-air flying machine having an aeroplane surface and a centralized water-borne structure adapted to support the machine on the water and except for the aero lift being substantially the entire support at all speeds, said machine having in the direction of each lateral end thereof, a downwardly and rearwardly inclined narrow hydro-surface extending toward the water and adapted to be acted upon by the rush of the water as the machine loses its equilibrium."

S. Mortimer Ward, Jr., of the firm of Ward, Crosby and Smith, patent counsel for the Curtiss Company, in charge of this suit, states that in lay language, it may be said that the patent that will now be issued to the Curtiss Aeroplane and Motor Corporation, upon the invention of Glenn H. Curtiss, patent for which was formerly granted to Albert S. Janin, will cover in one aspect, a hydroaeroplane, whether of the flying boat or pontoon type, having a main water-borne structure capable of hydroplaning and supporting substantially the entire machine upon the water, said structure being so related to the wings of the craft as to enable the craft to be driven at hydroplaning speed upon the water and successfully flown from and back to the water, and with balancing means arranged laterally with respect to the water-borne structure, for engagement with the water, to maintain lateral balance of the machine during operation on the water.

Aircraft Industry Organizes Chamber of Commerce to Popularize Travel by Air

New York, Dec. 30.—Organization of the aircraft industry into a national body known as the Aeronautical Chamber of Commerce of America, with approximately 100 charter or founder members embracing the designing, constructing, operating and kindred elements, and representing virtually every section of the United States, was announced today at the Executive Offices, 501 Fifth Avenue. Among other things, it will develop the market and increase the use of flying machines among civilians, corporations and transportation companies.

The aircraft industry thus follows the example of all other modern industries which owe their present greatness in no small measure to the trade association. Organization of the Aeronautical Chamber of Commerce, following as it does the creation of the Bureau of Aeronautics in the Navy Department, and provision, in the Wadsworth-Hicks Bill, for a Commissioner of Civil Aviation in the Department of Commerce, and the nationalization and extension of the Aero Club of America, completes the accomplishments for the year and establishes the machinery whereby, it is believed, the development of American aviation will be greatly hastened.

The Aeronautical Chamber of Commerce of America is incorporated under the laws of the State of New York. Among its aims and purposes, as set forth in the Charter, are:

To foster, advance, promulgate, and promote trade and commerce, throughout the United States, its territories, possessions, and in foreign countries, in the interests of those persons, firms or corporations engaged in the business of manufacturing, buying, selling and dealing in aircraft, aircraft motors, and aircraft parts and accessories of every kind and nature.

To diffuse among its members accurate and reliable information as to the standing of its members and those persons, firms or corporations engaged in similar lines of business.

To procure uniformity and certainty in the customs and usages of trade and commerce among its members and those persons, firms or corporations having a common trade, business or professional interest in all matters pertaining to aeronautics.

To aid and assist in mapping out air roads and lanes; the location of landing fields, airdromes, hangars, or such other structures as may be necessary for the advancement of aeronautics.

To advocate and promote in every lawful way the enactment of just and equitable laws . . . pertaining to aeronautics.

To settle, adjust and arbitrate any and all differences which may arise between its members, and persons, firms or corporations dealing with them.

To promote a more enlarged and friendly intercourse between its members, persons, firms and corporations engaged in the business of, or dealing in, aircraft, aircraft motors and aircraft parts and accessories, and generally to do every act and thing which may be necessary and proper for the advancement of the aeronautical art and industry and the accomplishment of the objects and purposes hereinbefore set forth; provided, however, that nothing herein contained shall authorize this corporation to engage in any business for pecuniary profit.

Complete details of this important new aeronautic organization will be given in our next issue.

STANDARDIZATION AND AERODYNAMICS

By PROF. VON KARMAN

University of Aachen. (Germany)

Introductory Note

The suggestions offered by W. Knight in the AERIAL AGE of June 20th, 1921, as to the desirability of calling a conference in the United States among representatives of leading aeronautical scientific organizations with a view of reaching an international agreement on the subject of Standardization and Aerodynamics was taken up by Prof. L. Prandt of the University of Göttingen, Germany, and in the October 3rd issue of the AERIAL AGE his views on this matter were given. Prof. Dr. von Karman of the University of Aachen, a most brilliant scientist who has been prominent in the development of aeronautics in Austria during the war and who is now at the head of the Aachen aerodynamic laboratory, writes to Mr. Knight the following letter and gives his views on "Standardization and Aerodynamics" which are presented to the readers of the AERIAL AGE.

DEAR MR. KNIGHT,—

I am sending you herewith attached a few notes giving my views on the very important point that you have recently raised in the AERIAL AGE on the subject of Standardization and Aerodynamics, which you may publish if you think it worth while.

There is no doubt that if you can succeed in bringing together former allied and former enemy scientists for discussing a problem which interests everybody, you shall have greatly contributed to the scientific development of aerodynamics.

In my opinion it should be desirable, to begin with, to have a preliminary conference between a few of the most prominent scientists and technical men interested in this matter for discussing the best means for creating an international scientific aeronautical association which is the best suited for bringing about a much desirable cooperation among aerodynamical research workers.

I think that an association organized along the same general lines as the International Society for testing materials shall admirably serve our purposes.

This preliminary conference that I am suggesting for laying the foundation of a permanent international scientific aeronautical association should be desirable if it took place in Europe, in some place having an international character, and I suggest for this purpose the southern Tyrol (Italian Tyrol), at Bozen or Mezan.

Yours very cordially,

VON KARMAN.

Professor von Karman's Suggestions

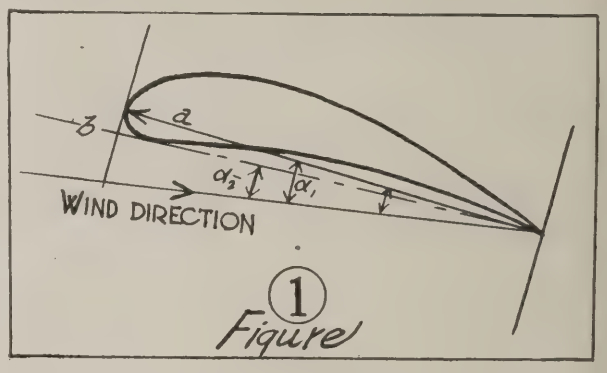
IN its early stages a new science labors under the advantage of the possibility of having its development directed from the beginning in an orderly and systematic manner. The primary requirement to this end is the international standardization of definitions and symbols, and it would be of great value to aerodynamics if America were to take the lead in this matter. The most important problems that should be taken up in such an undertaking, in the writer's opinion, are the following:

1. *Standardization of Coefficients.*

The standardization of nomenclature and derivation of coefficients is not a purely objective matter, as it is based upon a thorough understanding of the theoretical foundations of aerodynamics. In spite of the apparent simplicity of the French system, I believe that preference should be accorded to "abstract" coefficients, independent of dimensions, as the laws of mechanical similarity are more clearly evident by their use. Ever since the importance of Reynold's index has been clearly recognized, most laws of resistance can only be applied when this number is contained as a parameter, in which cases the use of abstract coefficients is evident. Many complicated phenomena, such as surface friction or heat-transference in turbulent gases and liquids, would have been explained much sooner if early investigators had expressed their results by empirical formulas in terms of concrete entities and abstract coefficients.

2. *Standardization in Methods of Measurement.*

For the correct *measurement of air-speed* it is essential to establish standard methods, if results obtained in different laboratories are to be compared with safety. Measuring instruments such as the Pitot tube, should be standardized as to shape with the eventual selection of a "standard" at some central point for comparative reference. Unfortunately (as expressed in the article by H. Prandtl in the issue of Oct. 3rd, 1921), the speed thus measured is not a true expression, depending, as it does, on the magnitude of the vibrations or the so-called *degree of turbulence.* It would be a thankful task for a laboratory to build apparatus for the determination of these factors. Meanwhile it would seem advisable to follow the suggestion of Mr. W. Knight to have a few simple bodies experimented with in *all* important laboratories and have the results thus obtained compared and reduced to a common proportionate expression.



1 Figure

Thus it would be possible to determine accurately the resistance of a circular disc or a sphere of a given diameter and adopt that dimension as a standard. In fact, in view of our limited knowledge of the influence of surface conditions or unavoidable variations in the making of similar models it would be best to have the same model make a round trip to every laboratory adapted for such work.

3. *Standardization of Definitions and Symbols.*

Next to the standardization of coefficients and their relationships an agreement should be reached as to definitions and symbols. For example, take the definition of Angle of Incidence, which in Austria and England is defined as the angle between the direction of the air-stream and the so-called maximum chord (a) (in fig. 1) while in other countries the lower tangent to the profile passing through the trailing edge is taken as a basis. (b) Many other elements can be conceived in different ways and are therefore of doubtful interpretation. In speaking of wing-surface and wing-loading it is undetermined to what extent ailerons can be assumed to be part of the carrying surface, or in the case of strong dihedrals whether the surface itself or its horizontal equivalent is to be taken as a basis of calculation. In this case even the meaning of the word "span" becomes subject to misinterpretation. Aspect ratio, which plays such an important part in modern wing-theory, becomes an inderterminate quantity when applied to diminishing chords. To afford a useful basis for description and comparison of aircraft it is imperative that all such elements be defined without possibility of misunderstanding.

A similar divergence in methods applies to the determination of efficiencies. The efficiency of a propeller has been defined by three or four scientifically justifiable expressions, and nevertheless we often read the old $\frac{\text{traction}}{\text{Horsepower}}$ formula, which is in no way characteristic of the efficiency of a screw as it takes neither speed nor dimensions into consideration.

From the above random examples we see that a comparison of opinions and a sifting of various methods now in use would bear good fruit. An *immediate* understanding on work in course of preparation or contemplated would result in the avoidance of duplication and would insure that every experiment be undertaken in the laboratory already best equipped to carry on its particular share of the work. The activities of the International Association for Testing Materials, which in pre-war days co-related and assisted in preparing the results obtained in all laboratories, could well serve as an example. If such activities could be extended towards the practical side of aircraft design, as for instance in the comparison and standardization of methods of calculation, determination of factors of safety, etc., a magnificent program could be outlined, the realization of which will be of maximal importance to the further development of the science of flight.

THE CURTISS-NAVY RACER

THE Curtiss Navy Racer was built during 1921 on Navy order, for the purpose of using it in such contests as the Pulitzer Trophy Race, with the idea that motors and aeroplanes in competition contribute greatly to the knowledge of the air services with regard to the possibility of their use for military purposes, and due to the fact that when engineers go about to conceive and produce a racing type of machine, they generally make considerable advances in the art useful for military pursuit types.

The Curtiss Navy Racer is a biplane of 22′ 8″ span, 21′ .5″ length, and 8′ 11″ height. It has a total supporting area of 168 sq. ft., and a full load weight of 2,165 lb. The power plant is a Curtiss CD-12 engine of 400 b.h.p. This motor is especially suited to small high-powered ships of the pursuit type on account of its light weight, small size and the ease with which it can be streamlined into the structure.

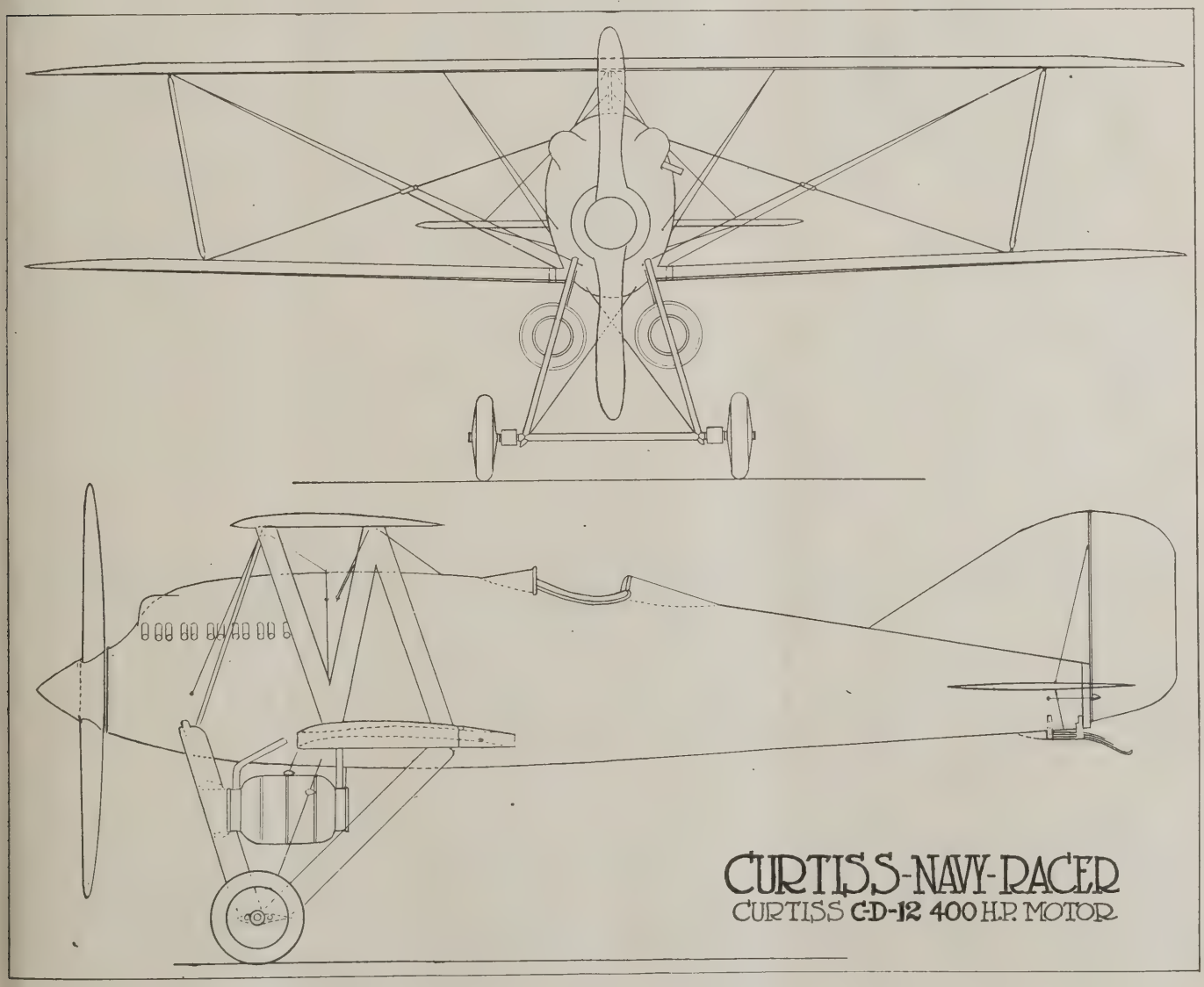
Contract was let for the construction of two machines about the first of June, 1921, and one machine was completed ready to fly on August 1, 1921; another machine exactly similar, was finished August 8, 1921. These machines were first flown early in August, with Bert Acosta as pilot, at the Curtiss Field, Mineola. The flight tests were made by Mr. Bert Acosta and Lieut. Bradley, of the U. S. Marine Corps, during August and September and the early part of October. When it was definitely decided that the Navy and Army Air Services would not compete for the Pulitzer Trophy in the race at Omaha, the Curtiss Aeroplane & Motor Corporation requested the loan of one of the Navy Racers for the competition, which loan was granted by the Navy Department.

In developing the design of the Curtiss Navy Racer, nothing radical was attempted, as the Curtiss Company and the Bureau of Aeronautics of the Navy believe greater progress in the art and industry can be attained in the developing of high speed machines by maintaining factors of safety suitable for military pursuit ships with maneuverability and landing speeds that will permit the ship to be flown from and landed in an ordinarily good flying field.

The Curtiss Navy Racer maintained a speed of 176.7 m.p.h. over a triangular course of 30.7 miles for a distance of 153.59 miles, which is a world's record.

Following are some general specifications of the Curtiss Navy Racer:

Span	22′ 8″
Length	21′ .5″
Height	8′ 11″
Chord	48″
Gap	48″
Stagger	15″
Tread	60″
Factor of Safety of Wings	9
Motor, Curtiss CD-12	400 hp.
Gas Consumption	.5 lb per h.p. hr.
Oil Consumption	.015 lb per h.p. hr.



AERONAUTIC LESSONS FROM EUROPE

By RALPH UPSON.*

In going back and forth between Europe and America, I have discovered a very curious bit of psychology. In this country it seems to be the style, among those aeronautically inclined, to hold Europe up as a model, to call particular attention to her selected successes in commercial aviation, her government subsidies, her published statistics, with exhortation to the United States to go and do likewise. But when I get to Europe I find precisely the same attitude with respect to us. "Watch America," they say, "she is really doing things. Look at the huge number of passengers carried in the last year, the success of the aerial mail, the organization of a big airship company."

Suppose we follow through along this line:—We copy Europe, Europe copies us. Where do we get? Where does anyone get by mere copying? We have our own conditions, and our own problems to solve, for each of which there is only one best solution. We have capable men and adequate facilities, with a volume of high grade traffic and a valuation of time unexampled anywhere else in the world.

Taking aeronautics as a whole, the possibilities in America are far more encouraging than in Europe. A study of European developments cannot help but be of great value, but we must use the lessons gained as a help in working out our own plans, not as a substitute for them.

Now that we have cleared the air a little, let us see what has really happened in Europe. There is no use going back further than the end of the war. During the first few months of peace, great numbers of aircraft of all different sizes were dumped, scrapped or otherwise disposed of. Airplanes were literally as cheap as dirt. As business was still generally good it was a great incentive to try and use some of these planes and accessory equipment for commercial purposes.

To accomplish anything it was first necessary to give aviation some kind of a legal status, especially for international service. So the allied nations got together and framed up a most valuable code covering rights and duties of operators, responsibilities to the public, requirements for safety, etc., which is the basis for everything that has since been done in Europe. America does not share any benefits of this work because it was dimly related to the League of Nations.

Commercial flying was well started within a year after the armistice; but the operating companies soon found that they were losing money, in spite of the fact that they were getting their planes and terminal facilities practically for nothing. We now know the reason; that the average war plane was a poor investment for commercial use *even when accepted as a gift.*

At that time the most obvious solution of the financial difficulty was government subsidy. France led the way with very liberal subsidies, and it must be admitted that aviation in France today is in a very flourishing condition, as far as the actual operating companies are concerned. But I do not feel that the French got far enough with the unsubsidized industry to really give it a good trial. Experience from England is more enlightening in this respect.

The English cross-channel service was started in the spring of 1919 by the Airco & Handley-Page Companies. Both used made-over war machines, but as far as the passenger accommodations were concerned they were carefully redesigned. They ran for a little over a year, not making any profits, but also not losing much. The fare from London to Paris, reduced to American units, was about $42. In the spring of 1920 they were beginning to realize that merchandise was a great deal cheaper to haul, pound for pound, than passengers. So, in a last attempt to produce profits, the express rates were reduced and the passenger fares raised. In the meantime the competition of the subsidized French lines was getting very serious, resulting in a substantial reduction of both passenger and express rates.

The condition of the British lines came quickly to a crisis. Mr. Holt-Thomas, the head of the Airco system, withdrew from the field. He wrote me soon afterwards that he was far from discouraged about the future of aviation but that under existing conditions he simply could not make it pay. He claimed the principal trouble was that the traffic was not big enough; that they could make sure profits even on the lower rates if they could get more volume of business, partcularly merchandise. But people were not yet educated to appreciate the value of fast transpor-

The Handley-Page Co. soon after got assurance of government support and continued to operate. The Instone Air Line was organized on a basis of similar promises and took over what was left of the Airco business. Thus England entered the regular subsidy class.

Today both French and English lines operate between Paris and London on a fare of $21, which is not quite double the first class fare by train and boat. Government subsidy has been accepted as a practical necessity by nearly every country in Europe. In France, in a little over a year's time, passengers carried increased 2½ times, merchandise 3 times and mail 4 times. Several of the companies have run through the whole season without a single accident. The regularity also has been surprisingly good. Let me give you an example: On September 18, the day of the International Balloon Race from Brussels, we started up in a wind of over 30 miles per hour, and the worst kind of general weather conditions. After landing, two days later, I learned that with the exception of the balloons, not a single aircraft had been able to cross the Channel that day. *But it was the first time since March that the service had been so completely suspended.*

Air lines are now branching out to every important point in Europe. Here is a time table, for example, that gives full information for all lines originating in France. A regular schedule is maintained from Toulouse, France, to Cassablanca, on the west coast of Morocco, a straight line distance of nearly 900 miles, and an airship line is to be started next spring.

But with all this encouraging development it does not seem thoroughly sound. The statistics are all right, but statistics cannot tell the whole story. To speak plainly "there is something rotten in Denmark," and in every other country for that matter. The fundamental fault is that the subsidy is granted almost entirely for military reasons. For the most part it is essentially a premium on mere operation. Where new designs are encouraged, stress is put on the military features. It is an inherently vicious system because it is self perpetuating, by discouraging the only kind of development that can put aviation on its own feet. In this I am not trying to criticize European methods which have been conspicuously successful for the purpose intended. But the American people have a very just suspicion of any kind of direct subsidy. Not only that but I think I voice the majority opinion of aircraft men themselves by saying that we do not need and do not want any subsidy for the operation of aircraft in America. With all due respect to the steamship companies, we do not want an industry that has to be continually drugged to keep it alive. If that is the kind of business we are pushing, it does not deserve any help.

But is there anyone now so pessimistic as not to believe in the future of aviation? I do not feel that it is necessary at this late day for me to take up your time simply arguing the importance of aviation. Let us be done with merely asking and answering the same old question, "Will aviation be worth while?" That question is absolutely settled; it will be worth while, and all we need to do is to go out and make it so. I say "we" in a broad sense to include, of course, our own government. We may very well feel that some of the foreign governments are too paternalistic, but that does not mean that we should sit and do nothing. How could our railroads ever have developed without government co-operation? We can at least do as much for aviation.

I need hardly mention the main essentials, on which everyone seems to be in agreement. Some form of central governmental bureau for civilian aeronautics, such as provided for in the Wadsworth-Hicks bill, is the most natural starting point. Public confidence, safety of operation, the financing of new undertakings, the lay-out of routes and a proper basis for insurance will all be much facilitated by proper government co-operation.

But while we are justly concerned with the means and methods for promoting the use of aircraft, we must not forget the main purpose, the big idea. Let other nations back commercial aviation for its military value. If we can only develop its real commercial value, the other will take care of itself; for a self supporting, going industry, which is an economic asset to the country, is the best military asset as well. To attain this, the most serious problems are the technical ones, mainly involved in the design of the machines themselves.

I will close with a very definite suggestion. France is spending $2,500,000 per year on aircraft subsidies, which shows every indication of being perpetual. Let our government set aside, once and for all, one fifth of this amount that France spends in a single year. Divide it up into a series of prizes for the best new designs to accomplish the following objects, respectively:

1. Safety for passengers.
2. Economy for merchandise and mail.
3. Night flying.

If this is done properly, there is every reason to believe that the personal risk can be cut down to one-twentieth of its present value, little though it now is; that mail can be carried for a cost per pound of one-thirtieth the present cost, successful though our air mail already is; that aerial transportation will open up a great new field of its own, not to the injury of present transportation systems, but supplementing them to the great advantage of the whole public.

* Speech delivered before the Metropolitan Section S. A. E.

AERO CLUB OF AMERICA COMMITTEES

The following constitute the committees of the Aero Club of America for the fiscal year, November, 1921, to November, 1922:

House Committee

Cole J. Younger, Chairman
A. Travers Ewell
W. Daly
Charles Jerome Edwards
Augustus Post

Membership Committee

Col. Harold E. Hartney, Chairman
Philip J. Roosevelt
Eddie Rickenbacker

Law Committee

Philip A. Carroll, Chairman
W. W. Niles
Stephen Philbin
W. Jefferson Davis

Auditing Committee

George M. Houston, Chairman
Albert P. Loening
Cole J. Younger
Charles H. Cox

Airways & Maps Committee

A. Travers Ewell, Chairman
Howard A. Scholle
Major W. G. Schauffler
Hugh D. McKay
Major Smith (Fla.)
E. Lester Jones, Chief, U. S. Geodetic Survey
Ralph H. Upson
Charles J. Biddle
Horace Hickan
Otto Praeger
Col. E. H. Shaughnessy
Charles Dickenson
Capt. S. C. Coon
Albert B. Lambert
O. C. Merrill, Chairman, Board of Surveys and Maps of the Federal Government, Washington, D. C.
Fred Harvey, Jr.
Gould Dietz
Chas. A. Johnson, Denver, Colo.
Guy T. Slaughter
George B. Harrison
W. E. Boeing, Seattle, Wash.

Balloon Committee

Ralph H. Upson, Chairman
Howard A. Scholle
Allan R. Hawley
George M. Myers
Albert B. Lambert
Jerome Kingsbury
Thomas S. Baldwin
A. Leo Stevens
Augustus Post
Ward T. Van Orman

Collier Trophy Committee

Henry Crane, Chairman
William A. Larned
James A. Blair, Jr.
Caleb S. Bragg

Finance Committee

Howard E. Coffin, Chairman
C. M. Keys
Richard F. Hoyt
Philip J. Roosevelt

Special Banquet Committee

Benedict Crowell, Chairman
Howard E. Coffin
James A. Blair, Jr.
Maurice G. Cleary
Caleb S. Bragg
Cole J. Younger
Augustus Post
Howard A. Scholle

Foreign Relations Committee

Frank P. Lahm, Chairman
Major William A. Scully
Philip A. Carroll
F. Trubee Davison
Admiral Bradley A. Fiske, U. S. N.

Foreign Service Committee

Myron T. Herrick, Hon. Chairman
Sidney B. Veit, Hon. Secretary
Dr. A. L. Hipwell, Treasurer
Frank S. Lahm
William S. Hogan
E. L. Gros, M. D.
Louis D. Beaumont
G. Campbell Wood
Lt. Col. William Thaw
John Weare

Library Committee

Howard A. Scholle, Chairman
Cortlandt F. Bishop
Chas. Jerome Edwards
Ladislas D'Orcy
Ralph H. Upson

Technical Committee

Henry Crane, Chairman
Jesse G. Vincent
Grover C. Loening
Jerome C. Hunsaker
Rear Admiral B. A. Fiske
Elmer A. Sperry
Alexander A. Klemin
W. B. Stratton
Charles M. Manly
J. G. Coffin
Dr. A. F. Zahn
Commander H. C. Richardson
C. F. Marvin, Chief Weather Bureau
Capt. G. E. A. Halleck, McCook Field
H. C. Dickenson
W. D. A. Ryan, Gen. Elec. Co. (Lighting)
Major Thurman H. Bane
Glenn L. Martin
Chas. L. Laurence
Dr. F. L. Hunt, Bureau of Standards

Contest Committee

Regular Members.

Caleb S. Bragg, Chairman
Nelson Doubleday
Maurice G. Cleary
Harold E. Hartney
Harry F. Guggenheim
David McCullough
Henry Crane
Alexander Klemin
William A. Larned
Richard F. Hoyt
Howard Scholle

Associate Members.

R. W. Schroeder, Chicago
Eddie Rickenbacker, Detroit
Jesse T. Vincent, Detroit
Sidney D. Woldon, Detroit
Harold E. Hartney, Washington
Robert Breese, Paris

Timers.

R. A. Leavell, Chicago
L. M. Woolson, Detroit

The Present Officers of the Club are:

President, Benedict Crowell; 1st Vice-President, Chas. Jerome Edwards; 2nd Vice-President, James A. Blair, Jr.; 3rd Vice-President, Godfrey L. Cabot; 4th Vice-President, F. Trubee Davison; Treasurer, Philip, J. Roosevelt; Executive Secretary, Harold E. Hartney; Recording Secretary, Augustus Post.

The Governors are:

S. R. Bertron, James A. Blair, Jr., Chas. J. Biddle, Cortlandt Field Bishop, Caleb S. Bragg, Godfrey L. Cabot, Philip A. Carroll, Benjamin F. Castle, Maurice G. Cleary, Howard E. Coffin, Benedict Crowell, F. Trubee Davison, Gould Dietz, Nelson Doubleday, Chas. Jerome Edwards, Bradley A. Fiske, U. S. N., Myron T. Herrick, George H. Houston, Richard F. Hoyt, Albert Bond Lambert, John D. Larkin, William A. Larned, Charles E. Merrill, George M. Myers, Arthur A. O'Brien, Philip J. Roosevelt, Lorillard Spencer.

SUPPLEMENTARY REPORT ON EXPERIMENTAL REINFORCED PLYWOOD TRUSS RIBS

Since the writing of the original report on "Experimental Reinforced Plywood Truss Ribs" considerable progress has been made in the development of reinforced plywood truss ribs with reinforcing on only one side of the web. This type of construction is obviously a great deal better adapted to production than the former. The results of our investigation prove that the economy in production is accompanied by but a slight increase in weight.

The design data was the same as that upon which the original ribs were based and is tabulated in Table V. The fixity coefficient of the web members was modified as follows: Two in the plane of the truss, and 1.25 in a plane perpendicular to the plane of the truss..

The material was the same as used in the original ribs consisting of 3/16 inch spruce-poplar plywood with the spruce face plies horizontal. The plies were of equal thickness. The cap strip and web reinforcing strips were spruce.

It was considered advisable to adapt the Warren truss type of construction with the diagonals adjacent to the spars taking compression. The outline of the truss is the same as for ribs 1 and 2 of the original design. The direct stresses, and the bending moments in the chords will be the same consequently, and are tabulated in Table VI under ribs 595-1 and 2.

Design of Web Members

The web members consisted of a strip of plywood to which was glued a spruce reinforcing strip. The stress was applied through the plywood at the extremities of the web members and transmitted to the reinforcing strips through the glued surface. Sufficient gluing surface was provided to develop the reinforcing strips. The design of the web members was at first based on the direct stresses only, but it was found in the test that the effect of the eccentric application of the load could not be ignored. Therefore, the design of the web mem-

bers was changed and the compression members were designed by the method of secondary deflections. The heavily stressed compression diagonals adjacent to the spars could not be designed economically with reinforcing strips on one side, so it was thought advisable to reinforce these two members with strips on both sides. The other compression web members, however, were analyzed as columns eccentrically loaded by the method of secondary deflections and the design proved very satisfactory. To illustrate its application the design of member 5-6 will be worked out in detail.

Member 5-6. Vertical web member:

Stress = —223 pounds.
Length = 18.85 inches.
Effectiveness of plywood = 0.435 referred to spruce.
Effective area = 0.2436 square inches.
$X_{c.g.} = 0.358$ in.
$I_{c.g.} = 0.00926$ in.^{4}
$r = 0.195$ in.

The primary eccentricity is equal to the sum of the initial eccentricity in the member which is equal to the distance from the center of the plywood to the center of gravity of the section, and the deflection due to the load.

$$\text{Primary deflection} = (X_{c.g} - 3/32) + \frac{ML^2}{8EI}$$

$$= (0.358 - 0.094) + \frac{223 \times 0.264 \times 18.85^2}{8 \times 1{,}600{,}000 \times 0.00926} = 0.440 \text{ in.}$$

Primary bending moment $= 223 \times 0.440 = 98.2$ in. lbs.

The next step is to determine the uniform load which will produce the same bending moment at the center of a beam freely supported at the ends.

$$98.2 = \frac{wL^2}{8}; \quad w = 2.21 \text{ lbs. per linear inch.}$$

$$\text{Deflection due to uniform load} = \frac{5}{384} \frac{wL^4}{EI}$$

$$= \frac{5}{384} \times \frac{2.21 \times 18.85^4}{1{,}6000{,}000 \times 0.00926} = 0.246 \text{ in.}$$

Ratio between secondary and primary eccentricities

$$= \frac{0.246}{0.440} = 0.558.$$

The total bending moment is the sum of a series which may be determined as follows:

$$M = \frac{M \text{ primary}}{1 - 0.558} = \frac{98.2}{0.442} = 223 \text{ in. lbs.}$$

$$f_c = \text{fiber stress in direct compression} = \frac{223}{0.2436} = 920 \text{ lbs.}$$

per sq. in.

f_b = fiber stress in bending (compression fibers)

$$= \frac{223 \times 0.358}{0.00926} = \frac{8625}{9545} \text{ lbs. per sq. in.}$$

$$f \text{ allowable} = \frac{f_b}{f_b + f_c}(F - C) + C = \frac{8625}{9545}(10300 - 2200)$$

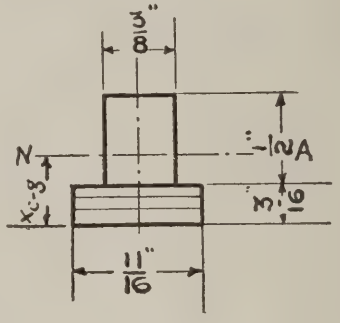
$$+ 2200 = 9525 \text{ lbs. per sq. in.}$$

Design of Chord Members

In the design of the chord members the face plies were considered fully effective and the core was ignored. The members were designed in the same manner as for the original ribs for direct stresses and bending moments. The effect of the eccentricity in the application of the direct stresses was ignored. The effect of column action at the panel points was allowed for by considering that each chord member was a column with a length equal to 25 per cent of the sum of the adjacent panels. The allowable stresses were reduced in accordance with the formula stated above for the design of web members. The stresses due to bending were computed about a horizontal axis through the center of gravity of the chord section. The theoretically correct method would be to determine the principal axes, moment of inertia about the principal axes, and finally the stresses at the extreme fibers. The analysis used, however, gave a uniform and adequate design. In the test the chords were restrained by guides from buckling sidewise. The fabric will exert the same restraining influence when the rib is assembled on a wing for flight.

The following test data was obtained during the test for low incidence. The distribution of the load along the chord for this type of loading is considered fully in the original report.

The test data was secured in the wood laboratory of the materials section. The test was conducted by Mr. R. L. Hankinson.



Test data on plywood truss ribs 180-in. chord with stiffeners on one side.

Rib No.	Total load	Deflection at center between beams	Weight in ounces	Failure
1	600	0.228	54.1	Buckling in lower chords; compression members in front of rear spar and in rear of front spar were strengthened by adding two pieces of 3-16-inch spruce.
1	600	.206	54.93	Column bending noted in compression members in front of rear spar and in rear of front spar. Various members strengthened (°).
1	750	.360	55.65	Test stopped on account of glue shear failure in front of rear wing beam.
1	1,200	.418	55.65	Failure in lower chord in second bay in rear of front wing beam by buckling and shear.
2	900	.285	56.05	Various members strengthened before test, Spar fastening failed, test stopped.
2	1,050	.304	56.05	Testing apparatus failed; no failure in rib.
2	1,250	.385	56.05	Compression member in front of the rear spar deflected in plane of the rib.

The strength-weight ratio of the first rib tested was 21.5 and of the second rib tested was 22.3 expressed in load supported divided by weight of final rib in ounces. This compares well with the strength-weight ratio of the original ribs, the difference being due to the additional material required in the web when designed for eccentric loads.

Conclusion

This type of construction is recommended strongly for its adaptability to production and strength. The only members which need be reinforced on both sides are the heavily stressed compression diagonals within and adjacent to the spars. The construction in which both sides of the web are reinforced is more stable laterally. To secure lateral stability when the construction in which reinforcing is used on only one side of the web is adapted, special care should be taken to secure lateral rigidity. This may be secured by section laths running along the top and bottom of the ribs parallel to the spars and attached to the ribs. These stringers should be fastened to the compression ribs in order to stabilize the series of ribs intervening. It is thought that taping alone will not be adequate to secure the necessary lateral rigidity.

[*Air Service Information Circular, Vol. III., No. 268.*]

COMPARATIVE EFFECT ON ENGINE OPERATION IN FLIGHT OF OUTSIDE AND INSIDE AIR INTAKES

Object of Test

This test was made to determine the effect on the engine operation in flight when taking the carburetor air from inside the engine cowling.

Summary and Conclusions

No difference in engine operation when using air from inside or outside the cowling can be observed. It is concluded, therefore, that either type of air intake as desired can be used. The outside air intake is much to be preferred on account of reduced fire risk.

Introduction

There has been considerable discussion among aeronautical engineers as to the relative merits of the outside and inside air intakes for airplane engines. The outside air intake, projecting through the engine cowling and cut off at an angle of 30° with the center line of the airplane, is standard practice with the Air Service (see Fig. 1). This type of intake is very important in reducing fire risk and insuring a supply of fresh air to the carburetors at all times.

It has been contended by some engineers, however, that engine operation would be greatly improved, especially at the higher altitudes, by taking warm air from inside the cowling, back of the radiator. It is claimed that this method also has the advantage of taking the carburetor air from an undisturbed location, rather than from a high velocity slipstream. This test was undertaken to determine whether or not the inside air intake possessed these possible advantages.

Description of Intakes

A vertical air scoop used with an NAD-6 carburetor on a Model "H" Hispano-Suiza engine was opened at the elbow and a short, straight piece of pipe fitted and brazed to the opening, arranged so that the vertical pipe took the air from the outside, while the straight extension took the air from the inside of the cowling. Large butterfly throttles were installed in each air scoop and, by means of a rod, operative from the pilot's cockpit. These throttles were interconnected, so that both air scoops could not be opened simultaneously. (See Fig. 1.)

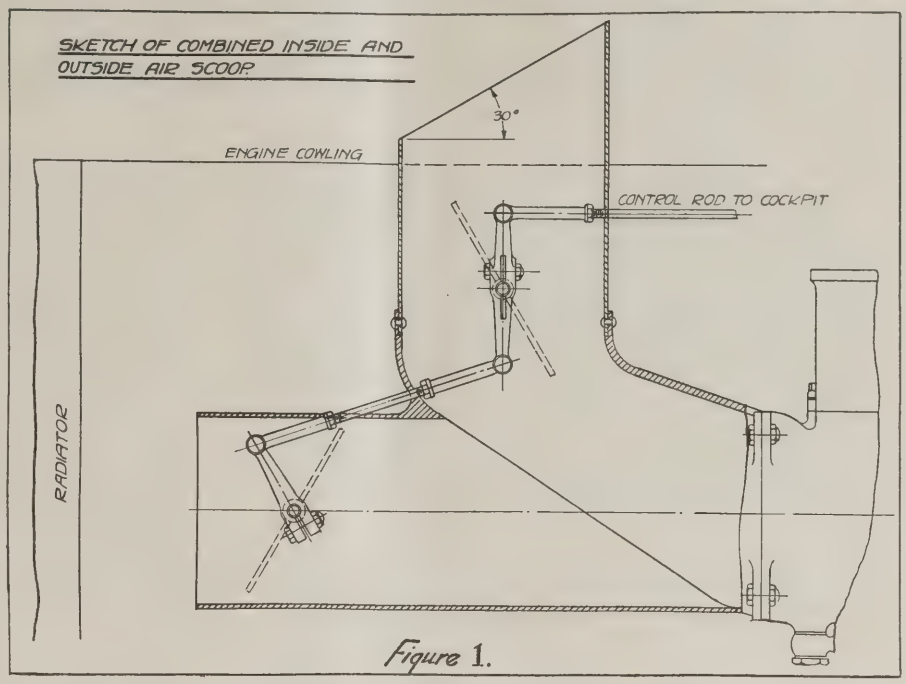


Figure 1.

Method of Test

A flight was made to about twenty thousand feet, at which altitude, in level flight, the air to the engine was drawn alternately from the two airscoops. The acceleration was also tried with each air supply by rapid opening and closing of the throttle. This was repeated at various lower altitudes, specifically sixteen, twelve, eight, and four thousand feet. The test was made in a two-seater experimental aeroplane, type XB-1A, and the ground temperature was approximately 89° F.

Results

No difference in engine operation, as indicated by engine revolutions per minute or acceleration, could be noted with either type of air intake. It is possible that warming the air to the carburetors may be of advantage in cold weather at low altitudes, but, due to the increased fire risk caused by the inside air intake, it is not recommended for this purpose. — *Air Science Information Circular.*

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut Street
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
J. SIDNEY OWENS, *2d Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. BAMBERGER
CHARLES L. HOWER
GEORGE S. IRELAND
FRANK A. L. LEAHY
JOHN W. PRATT
D. J. SPENCE, JR.
A. STANLEY TRUSCOTT

On December 22nd a most important meeting will be held in Philadelphia, by the Society of Automotive Engineers, to discuss the topic of aerial transportation. The Society of Automotive Engineers, whose membership of over 5,000 is composed of many of the foremost engineers, including a large number of the country's most prominent aircraft designers and builders, will hold a series of meetings at which various speakers will tell what has actually been done in this country and abroad in the way of commercial aviation.

The cost of aerial transportation per passenger mile and per ton mile will be given from figures obtained from flights that have actually been made on regular schedules. After recounting what has been done to date, the problems still to be solved will be discussed.

Among the important subjects that will receive attention are airways, landing fields, ground organization, legal aspects, radio and meteorological service and the relation of civil aviation to national defense. In connection with this last subject moving pictures will be shown of the recent bombing operation against the surrendered German battleships. These pictures have not previously been shown publicly.

Those who will take part in this program include J. G. Vincent, prominently identified with the Liberty motor; Glenn L. Martin, one of the pioneers of aviation; Ralph Upson, balloon expert, and Assistant Postmaster General Shaughnessy, who will give to the meeting important data regarding the air mail service.

With the idea in view of making Philadelphia one of the great airports of the country and to bring to the city its share of the aeroplane industry, the Chamber of Commerce has appointed a Committee on Aviation.

This committee is composed of the following members: Samuel B. Eckert, chairman, a major in the British flying forces during the war; Charles J. Biddle, who was a major with the American flying forces; Alfred M. Cohen, formerly a commander in the Navy; Stephen H. Noyes, an assistant bridge engineer for the city; Robert Glendinning, formerly of the American air forces in France; Joseph A. Steinmetz, president of the Aero Club of Pennsylvania and former president of the Engineers' Club, and Hollingshead N. Taylor, chairman of the Industrial Committee of the Chamber.

Uncle Sam has rendered a decision that children cannot be forwarded by aeroplane parcel post. Application was recently made by Mrs. Mary Pyle, of Washington, D. C. who wanted to send her three-year-old daughter Airlie to Philadelphia by air mail. Mrs. Pyle filed her application with the postmaster at Washington, requesting permission to ship her baby to Philadelphia in one of the Government mail carrying planes so she could spend the Christmas holidays with relatives in that city.

The request was refused on the ruling made some time ago under which the Postoffice Department stated children could not be sent from place to place as parcel post. The mother was also informed that the air mail service between Philadelphia and Washington was discontinued some time ago.

The stated monthly meeting of the Club was held the evening of November 25th, at the Club quarters in the Penn and Pencil clubhouse, 1026 Walnut Street. A large number of the members were in attendance to hear the report of the various committees and officers. During the month there had been special meetings when the matter of Philadelphia's future aeronautic activities and establishment of air fields and the development of air transports, were matters of interesting discussion.

The members present also discussed new names for nomination of officers and directors for the coming year and an earnest plea was made by Mr. Steinmetz, president of the Club, that the younger men and service groups be given consideration so that the Club shall derive inspiration, courage and new points of view from the men active in aerial development.

It was also decided to terminate the lease of the present quarters and file a formal application for affiliation with the Engineers' Club. It is felt by nearly all the members of the Aero Club that such an affiliation will give privileges which the Club does not at present have and will do much toward building up a large membership during the coming year. It is expected that the Club will soon be called upon to take an important part in the plans maturing for the Sesqui-Centennial of 1926, and will undoubtedly have charge of the aerial activities of the great celebration. The invitation of the Aero Club of Pennsylvania was extended to all the great aerial societies of France and England, and it is believed that thousands will arrive by the great airliners which by that time will be crossing the Atlantic over mapped and charted routes of the air.

The December meeting of the Club was held on the evening of the 16th, at the Engineers' Club of Philadelphia. A most interesting meeting was held and Mr. E. R. Armstrong, one of the pioneers of aviation, gave a talk on practical trans-Atlantic transportation, based on the study he has been making of the problem for years.

Mr. Armstrong has basic patents on practical anchorages for landing stations placed at "hops" of 500 miles apart in order to reduce the tremendous fuel load required by air-liners making non-stop flights. The entire idea has been worked out by Mr. Armstrong as an engineering problem and not a visionary scheme. Mr. Armstrong is well known in aeronautical work having contributed many writings to *Aero and Hydro,* one of the first aeronautical magazines published.

The following nominations of officers of the Club, for the coming year, were made. The election to take place at the annual meeting, January 20th: Joseph A. Steinmetz, president; William H. Shean, 1st vice president; H. F. Bamberger, 2nd vice president; George S. Gassner, secretary and treasurer; Chas. L. Hower, George S. Ireland, W. Wallace Kellett, Frank A. L. Leahy, R. G. Miller, D. J. Spence, Jr., and A. Stanley Truscott, directors.

W. H. SHEHAN,
1st Vice President.

REVIEW OF AMERICAN AVIATION FOR 1921

(*Concluded from page* 387)

ment and increasing importance of flight. The first American National Airway was opened by the Army Air Service between Bolling Field, Washington, D. C., and Dayton, Ohio. The Navy Department released four million dollars' worth of flying boat equipment for the civilian market at greatly reduced figures.

"Aviation units are being organized in the National Guard in many of the States of the Union. Many improvements were made in airplane design and in the internal combustion engine. Motors were made more reliable, more economical, as far as fuel consumption is concerned, and more efficient. New types of motors are being made, including the Wright, Lawrance, Packard, etc., radial, air-cooled, and steam, and what promises to be one of the most powerful in the world—an internal combustion engine of 700 horsepower under test at McCook Field, Dayton, Ohio.

"There were several distinct scientific advances. The aerial torpedo was produced, a secret invention and one of far reaching influence on aviation in peace and war. The 4,300 pound aerial bomb was also made and tested successfully, the Larsen all-metal armored monoplane carrying 30 machine guns, the torpedo carrying plane and the Navy scout. The geared propeller and multiple drive system was tested successfully by the Gallaudet Aircraft Corporation at East Greenwich, R. I. It permits the harnessing of three motors to one propeller. Perhaps a dozen different types of small sport machines were produced in this country in 1921. The Sperry 'Messenger' with Lawrance motor, the sport Farman, the Thomas-Morse racing monoplane, the Laird Swallow, the Longren folded wing sport plane, and others were introduced during the year.

"The U. S. Navy completed its giant dirigible hangar at Lakehurst, N. J. The Navy blimp C-7 was filled with non-inflammable helium gas and flown over Washington, D. C., to demonstrate its practicability. Lt. Ross Kirkpatrick made an American endurance flight record in a Curtiss plane of 18 hours and 6 minutes at Mitchel Field, L. I. The Foster Russell Aviation Co., of Spokane, Wash., made a 25,000 mile advertising flight among 225 towns in the Northwest. The Aeromarine 11-passenger flying cruiser 'Santa Maria' flew 9,000 miles on a Summer flight from Havana, Cuba, to New Orleans, via New York, Montreal, Toronto, Detroit, Chicago, St. Louis, and Memphis. The Navy launched a seaplane from its first catapult at League Island Navy Yard, Philadelphia, preparatory to equipping surface craft with fighting and scout planes. Fifteen flying boats of Aeromarine Airways alone flew 100,000 miles and carried 6,814 passengers, 29,002 pounds of freight and mail between Key West and Havana, and on the Atlantic Coast, Army, Navy and Marine Corps fliers made many important aerial surveys, such as those of the Olympic Peninsula in Oregon, the Mississippi River delta and the coastline of several islands in the West Indies.

"Forty-one army airplanes operated on the Aerial Forest Patrol in the National Forests on the Pacific Slope, made 396 patrols the last season, discovered 832 fires and daily provided protection to 7,230,459 square miles of valuable timber lands. The new Dayton-Wright forest patrol seaplanes were placed in operation in Canada during the Summer. Marine Corps planes used in revenue service located many stills on the Eastern Coast and on one occasion, last Sept. 2nd, located an entire moonshine village. The Bureau of Aeronautics was organized by the Navy Department, thereby co-ordinating the various divisions of Naval aviation. The First Air Brigade was organized by the Army Air Service at Langley Field, Va. Fliers patrol the entire Mexican border daily. The airplane rendered invaluable aid in flood, fire and pestilence, one of the most notable occasions being the Pueblo, Colo., flood last June.

"Approximately a score of flying meets were held in this country in 1921. Typical of these were the races, meets and demonstrations on Long Island, in Florida, Hartford, Conn., Baltimore, Chicago, Kokomo, Ind., Dallas, Denver, Oakland and Long Beach, Cal., several in Iowa and Nebraska and one of the most important, the American Legion Flying Meet at the National Convention in Kansas City, Mo., Oct. 31-Nov. 2nd."

NAVAL and MILITARY AERONAUTICS

Roma Christened

Washington.—The 400-foot army airship Roma fought her way for five hours and a half against a head wind from Langley Field to Washington Dec. 21 to be named and put in commission officially by Miss Fonrose Wainwright, daughter of the Assistant Secretary of War, who broke a bottle of liquid air on the prow of the dirigible.

Secretary Weeks, Secretary Denby and Senator Rolandi-Ricci, the Italian Ambassador, who participated in the ceremonies, waited for three hours in the chilling wind which blew from the northwest, for the ship to arrive. They were to have taken a flight in her over the city and to Baltimore with other invited guests, but the wind was rising steadily, and Major General Patrick, Chief of the Army Air Service, ordered the Roma back to her hangar at Langley Field as soon as she could be refueled.

The great dolphin-like craft arrived at Bolling Field at noon and departed at 2:30, scurrying home with the wind behind her, in two hours and forty minutes.

A crowd of guests and officers of the two air services awaited the arrival of the army's new semi-rigid, the largest lighter-than-air ship in this country, at Bolling Field from 9 o'clock, impatiently stamping their feet and trudging back and forth in an effort to keep warm. Aeroplanes left the field from time to time to search out the great ship, which was continually reported by radio as approaching from the southeast, but did not appear. Finally she was reported as over Alexandria, making slow progress against a stiff wind, with three of her motors frozen.

Suddenly in the southwest there appeared a great, dull-gray shape, scarcely distinguishable against the slate-colored sky. It was the Roma—a massive, fat dirigible, moving a little toward the east, slowly and majestically lifting her nose over the encircling hills. Gradually her bulk loomed up, and she swung toward the west, heading directly for the field, with her motors roaring deafeningly. Approaching quite low, she seemed barely to miss the trees and hangars as she pushed against the wind and finally, reaching the centre of the field, put her nose down and slowly settled.

A door in the V-shaped keel near the bow flew open and a great coil of rope dropped to the "handling" crew below. All hands took hold, and slowly the great craft came to earth.

The wind, sweeping from the north and west, swung the great ship back and forth as the men strained at the rope, while stay wires with cables attached were dropped out of ports along the keel to other men who stood by to steady her. Leveling off, but under the blast of her propellers, she settled on her "bumpers" and was landed, but she never stayed still a minute, swaying back and forth and carrying the men clinging to the ropes with her.

Then followed the naming by Miss Wainwright, who stood on a stepladder under the great curving bows as she broke the bottle of liquid air, which flew into a bluish-gray cloud of vapor as the glass crashed. The old ensign was then replaced by a new one presented by the Italians and hoisted high on the stern over her curious box-like rudder.

Speaking for Italy, where the ship was designed and built, Ambasador Rolandi-Ricci expressed his pleasure that America should have bought her, and Secretary Weeks, in accepting the airship for the War Department, said that the pleasure and opportunity were rather his, that the army should be so fortunate in securing a ship developed by the skill of Italian craftsmen.

Major J. G. Thornell and his staff of pilots and navigators were also thanked personally by Secretary Weeks for their successful trip, despite their handicap of an adverse wind and disabled motors.

After the naming the color presentation took place, Assistant Secretary Wainwright replying to Lieut. Gen. Giuseppe Vaccari, who spoke feelingly of the cordial relations between Italy and America as he presented the new American ensign for the Roma.

General Patrick then ordered the field cleared and the ship gassed and rebalanced for homeward flight. As the motors were tuned up the handling crew eased up on the hauling cable and the big ship rose slowly on an even keel.

As soon as she was clear of the field the "let go" signal was given and the cables were hauled up. She slowly forged ahead into the wind, turning to the southeast as she reached the edge of the field. At a height of a few hundred feet the engines were speeded up, and, assisted by the wind, she began her homeward trip at a high rate of speed, disappearing over the hills to the south.

Fire at Langley Field

Newport News.—Four large frame hangars at Langley Field were destroyed by fire Dec. 19. The property loss was more than $200,000. The origin of the fire is unknown and an investigation will be made by an army board of inquiry. One Martin bomber and most of the tools at the station were destroyed.

The buildings were among the first erected at the flying field several years ago. The fire originated in one of the centre buildings and spread so rapidly that all four were doomed in a few minutes. All but one or two machines housed in the hangars had been removed for practice purposes. This prevented a greater loss, as it was possible to remove only a very little equipment from any of the buildings.

Goodyear Making Navy Balloonettes

Akron, O.—Eighteen large balloonettes to be used as gas containers in the ZR-1, which will be the first rigid dirigible airship to be constructed in America, are being made for the Navy Department of the United States Government by the Goodyear Tire & Rubber Co.

The balloonettes will range in size from 200,000 cubic foot capacity down to 18,000 cubic feet. The government order calls for their delivery by July 1 to the navy hangar at Lakehurst, N. J. The hull of the ZR-1 is being made at Philadelphia.

In the manufacture of the huge gas containers, "Gold-beaters' skin" is being given its first extensive use in this country for the manufacture of balloon fabric. The material is the blind gut taken from the intestines of the steer. It was originally given the name of "Gold-beaters' skin" by reason of the fact that goldsmiths used the skins in making gold leaf by placing sheets of gold between the layers of skin and hammering into the filmy gold leaf.

Parts of the intestines of nearly one million steers will be used in the manufacture of the balloonettes. The use of the skins was first employed in Europe, never prior to this time having been extensively used in the United States. Goodyear is placing orders for the skins with all big packers in the country. They are being received in Akron packed in salt.

The membranes are soaked, cleansed and scraped and when dried each skin measures about 20 inches in length and eight inches in width. The skins are cemented together by a secret process and then are cemented over rubberized fabric and coated with shellac, forming a tough and slightly elastic lining for the gas containers.

The largest of the ZR-1 balloonettes being made by Goodyear is equivalent in gas capacity to that of the largest dirigible hull ever manufactured in this country. In other words, one of the ZR-1's eighteen balloonettes will be as large as most of the navy and army dirigibles of 200 foot length now in commission.

Goodyear is putting on a force of 300 girls and women to prepare the skins for the gas containers.

The C-7 Tests

Aeronautical experts agree that the three performances of the Airship C-7 with helium gas were excellent in every particular. The later part of the Hampton Roads Washington flight was made in a snow storm. Summed up, it can be said use of helium as a gas for the inflation of airships has been demonstrated beyond a doubt. Helium, with the exception of the fact that it is a slightly heavier gas, is superior in every other respect to hydrogen. In addition to the non-inflammable and absolutely inert character of helium and involves no fire risk whatsoever, the use of the gas is advantageous from the point of view of the operator as it does not expand and contract nearly as rapidly as hydrogen, a characteristic which makes for economical operation. The diffusion of helium is much less than hydrogen and especially through rubberized fabrics. During the three flights of the Airship C-7, no helium whatsoever was lost in operation by valving.

FOREIGN NEWS

The Ad Astral Silencer

There can be no doubt that the noise which accompanies flying in an aeroplane is a serious source of discomfort to passengers, and that any practicable method of reducing the noise deserves the attention of all designers of passenger-carrying aircraft. Although engine exhaust is by no means the sole cause of such noise it is nevertheless an appreciable part of it, particularly of such noise as is appreciable within the cabin of a modern passenger-carrying machine.

The Swiss Ad Astra Company, whose business is very largely of a joy-riding nature, have taken up this subject in earnest, and have developed and perfected a type of silencer designed by M. Birger, and now known as the Ad Astral Silencer.

This silencer is to some extent based on the same principles as the usual automobile silencer, in that it comprises an expansion chamber and a series of baffles, but it depends to an even greater extent on the thorough cooling of the exhaust gases, before they are allowed to escape. Obviously such cooling greatly reduces the volume of the said gases, and therefore the velocity of their escape, with consequent reduction in the noise.

The Ad Astral Silencer consists of a steel chamber of ovoid or streamline form, whose interior is divided up into three sections by nearly vertical partitions. The engine exhaust enters the central partition at the tail of this body, passes through to one of the side sections at the fore-end, passes across to the other side at the tail again, and emerges through a number of holes at the front of the body. But the gases do not yet escape into the open. Over the nose of the body is fitted an aluminium spinner, with deep spiral corrugations. This spinner is mounted in ball bearings, and is caused to spin by the action of the slipstream on the spiral corrugations. It is claimed that this rotary motion of the spinner causes marked turbulence in the gases within, a condition known to facilitate transfer of heat from the gas to the walls of the containing vessel.

A demonstration of this silencer fitted to a Siddeley "Puma" engine in a D.H.9 belonging to the British De Havilland Aircraft Company was arranged for Nov. 29th. Fog prevented flying on this occasion, but when running the engine on the ground, the silencer undoubtedly suppressed the exhaust noise of the engine, and very distinctly reduced the total volume of sound. It should be noted that at rest on the ground the noise directly due to the airscrew is considerably greater than when the machine is in flight.

Cutting in or out of the silencer with the engine running at full throttle did not produce the slightest flicker of the rev.-counter, and after a total of some ten minutes' run the silencer, and particularly the rotating nosepiece thereof, were remarkably cool.

Tests of the silencer made by the Swiss Federal Air Service Authorities indicate that the silencer does not reduce the power developed by the engine to which it is attached, and that if anything the engine runs cooler with than without the silencer.

The Royal Aircraft Establishment at Farnborough have tested the apparatus and have reported favorably as to its silencing properties.

The silencer appears to be somewhat bulky—the specimen used on the "Puma" is about 1 ft. diameter by 4 ft. long over all—and weight about 45 lbs., but one gathers that it was designed for an engine of some 360 h.p. Owing to its excellent shape the resistance is probably small, and there seems little doubt as to the excellence of its silencing properties.

The British rights in the Ad Astral Silencer are at present in the hands of Sir W. Maxwell, K.B.E., of 6, Broad Street Place, E.C.2.

Australian Air Mail

As the result of Government encouragement the first regular aerial mail service contract was accepted by Major Brearley, D.S.O., for a weekly service between Perth, Geraldton, and Derby, W. Australia. The service, which is booked to start every Monday from Perth, is intended to reach Geraldton before noon the same day, and Derby, which is 1,500 miles from Perth, shortly after noon on the Wednesday, returning to Perth on the Saturday afternoon.

The Defence Department has granted a subsidy of £25,000 for the service, which works out at the rate of 4d. per air mile. The machine to be used is a Bristol "Tourer" (240-h.p. Siddeley "Puma").

Unfortunately the first flight on Dec. 5th was marred by a fatal accident, at about 100 miles from Geraldton, when the machine piloted by Lieut. Fawcett, fell from a height of 50 feet and the pilot and mechanic-passenger were killed.

The Forthcoming Air Conference

The British Ministry announces that the first Air Conference proved so useful in focussing attention on the many and intricate problems of aviation and in bringing about a frank exchange of views on the subject, that the Air Council has decided to call together another Conference. This second air parliament will be held by permission of the Lord Mayor and Corporation at the Guildhall on February 7 and 8, 1922.

The conference, which will be opened by the Lord Mayor, will, on this occasion, be asked to address itself mainly to the question of the future of aviation, with special reference to its development as a regular and speedy form of commercial transport.

As a matter of convenience the papers will be divided into two main groups, the one dealing with civil aviation in general and the other with technical problems, the papers on the former subject being delivered at the morning session of the first day, and the papers on the latter during the afternoon session of the same day. The proceedings on the second day will be devoted wholly to discussions arising out of the previous day's papers, the morning session being allotted to civil aviation and the afternoon to discussions on the technical papers.

There will be two Chairmen: the Secretary of State for Air, who will preside during the civil aviation portion of the proceedings, and Lord Weir of Eastwood during the technical sessions.

The principal paper on civil aviation will be read by Lord Gorell, Under-Secretary of State for Air, who will give a general account of progress at home and abroad, and will direct attention to a consideration of the ways and means whereby the development of civil aviation at home and in the Empire may be best furthered. In this connection Lord Gorell will endeavor to enlist the practical co-operation of business and other interests.

The main technical paper will be read by Mr. F. M. Green, of Sir W. G. Armstrong, Whitworth Aircraft Limited; the names of the other speakers will be communicated later.

In order that the Conference may be fully representative of all sections of the community who are now interested in the development of aeronautics, or who are considered to have a potential and growing interest in air transport development, special invitations are being issued to all coming within these categories, particular efforts being made to secure so far as possible the attendance of representatives of large business groups and organizations.

Arrangements are being made which will permit of members of the Conference who desire to do so visiting the London terminal aerodrome at Croydon on Monday, February 6. The operations of the various Continental air transport companies will then be seen and explained; in addition, as many types of civil aircraft as possible will be concentrated at Croydon to afford members an opportunity of seeing for themselves the range which is being covered by commercial designs. Demonstrations of amphibian aircraft alighting on the Thames will also take place during the period of the Conference.

Aviation Finding a Home in Australia

The Australian Federal Government is carrying out its determination to utilize aircraft for long-distance postal and for limited passenger service, and the latest information upon this development comes from *The London Times'* Melbourne correspondent. Tenders have been accepted for such services between Adelaide and Sydney, and again between Sydney and Brisbane, 750 and 575 miles respectively as the crow flies. By rail the distance from Adelaide to Brisbane is 1,800 miles, and occupies four days. The subsidy for the first section is £17,500 a year, and for the second £11,500.

Tenders are also being called for a service between Charlesville and Cloncurry, in Queensland, a distance of 575 miles, much of it over country which in the rainy season is proctically impassable.

Recently an aviator arrived in the centre of Australia in comparatively few hours, covering a distance which occupies carters' wagons two months. Added to the service in West Australia, there will soon be 3,000 miles of postal and commercial aerial highways in constant operation. If the experiments are satisfactory, they will be extended and will solve one of the great communication problems of Australia.

On the other hand, the Federal Parliament has seen fit to reduce the Defence estimates by £100,000, which means the practical abondonment by the Government of the air scheme outlined earlier in the year. The two squadrons of flying boats have both been abandoned, and the two seaplane squadrons, one active and one reserve, modified to six machines, three active and three reserve. The scheme now amounts to the carrying on with what is possessed at the present time, with the addition of several Avros ordered at a local factory.

Irish Free State and Aviation

It is to be noted that in the peace terms with the new Irish Free State provision is made by the British Government for "Facilities in the neighborhood of the above Ports (Berehaven, Queenstown, Belfast Lough, and Lough Swilly) for Coastal Defense by Air," and further, that "A Convention shall be made between the same Governments for the regulation of Civil Communication by Air."

Congo Air Mail

The air mail service on the Upper Congo is now available. The rapid transmission of correspondence from Great Britain by the aeroplane service which has linked up with the European steamship arrangements is now operating between Kinshaba and Stanleyville. The air service is scheduled to take three days, as compared with fourteen days by river boats. An air letter fee of three francs per twenty grammes is chargeable to the addressee on delivery.

New Aluminum Alloy Developed

A new aluminum alloy, lighter than pure aluminum and said to have mechanical properties which make it superior to the ordinary aluminum-zink-copper alloy, has been developed in Germany and is being commercialized under the name silumin. It is an alloy of aluminum with 14 per cent silicon, its specific gravity (2.5 to 2.65) being about 10 per cent less than that of the most common aluminum alloys and also slightly less than that of the pure metal. The tensile strength of 28,400 lb per square inch is from 25 to 30 per cent greater than that of the alloys mentioned, and the elongation of 5 to 10 per cent is, on the average, more than twice as great. At high temperatures silumin is also superior to the ordinary alloys in this respect. With increasing temperature the tensile strength decreases at first slowly and then gradually more rapidly. The hardness at room temperature is 85,000 lb per square inch (under a load of 500 kg. and a 10-mm. ball); at 350 deg., 28,000 to 35,000 lb per square inch. Wet steam has hardly any effect on silumin, the same as on pure aluminum. Dilute hydrochloric acid (25 per cent), as well as concentrated acid, attack it less than pure aluminum. The new alloy is said to be a better conductor of heat than any other similar alloy, its conductivity being to that of pure aluminum as 4.7 is to 4. The coefficient of heat expansion is 0.88 in that of pure aluminum.

The alloy is produced by combining aluminum and silicon, but it can also be produced electrolitically. After it has been poured it is subjected to a heat treatment.—From Zeitschrift des Vereines Deutscher Ingenoieure.

Italian Constest in 1922

The Minister of War has approved the proposal of the High Command for Aeronautics to hold two flying contests during September, 1922, the Tyrrhenian Cup and the Italian Grand Prix.

There will also be a parachute competition with prizes of 500,000 lire and a balloon contest with prizes of 30,000 lire. All the above events are international.

In order to encourage those aircraft constructors whose machines do well in the contests, the Ministry of War has set aside 400,000 lire for the acquisition of these machines, which will then be handed to the civil aviation companies by way of subsidy, for the operation of civil air services.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark, Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

THE JUNIOR CLUB OF AERONAUTICS, KANSAS CITY, MO.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Successful Banquet of the I. M. A. C.

The tenth annual banquet of the Illinois Model Aero Club, held at the Auditorium Hotel, Chicago, on November 18th, was a complete success and larger than ever before.

A very attractive little menu and program booklet list the features of the evening's entertainment as follows:

Address, by president (Mr. Louis Chatroop); Toastmaster, Mr. J. J. Lucas; "The Past of the I. M. A. C.," Mr. D. W. Pease; Musical Selections, Mr. Jameson and Company; Readings, Mr. Richard Swander; "Today and Tomorrow with the I. M. A. C.," Mr. Warren H. De Lancey; "Mail Transportation in Nineteen-Fifty," by club members; "Why Fly Models?" Mr. James S. Stephens; Piano Solo, Mr. Raymond Oberndorf; "Boys' Sport," J. Lewis Coath; "Aircraft," Mr. Charles Dickenson; "The Dream of a Model Aviator," Mr. Topf; Song Leader, Master E. Lange.

Major R. W. Schroeder was to have given an address, but was prevented from attending because of illness in his family, but he announced later that he would offer a cross-country flight as a prize in the I. M. A. C. spring contests.

The banquet committee was composed of Joseph J. Lucas, chairman; Edward Topf, Walter Brock and W. H. De Lancey. The I. M. A. C. officers from July, 1921, to January, 1922, are as follows: President, Louis Chatroop; 1st Vice-President, Harry D. Wells; 2nd Vice-President, Walter Brock; Secretary, Robert Jaros; Treasurer, Lynn Davies; Contest Committee Chairman, W. H. De Lancey.

Air Scouts Organizing at Newport News, Va.

Under the leadership of Dashiell Wright, Boy Scouts of Newport News, Va., met at St. Paul's Parish House, December 9th, and started the ball rolling toward the organization in this country of Aerial Scouts.

Major Samuel Stewart, elected executive pro tem, is taking up with New York scout executives the matter of organizing the new class of scouts. The scouts in meeting asked him to do so.

Troop Number One, Boy Scouts, will ask for a new charter as Troop Number One, Aerial Scouts, and Troop Number Eight, Boy Scouts, will ask a new charter as Troop Number Two, Aerial Scouts.

"A lot of the fellows are interested," said Wright. "We will start off with a big group. Then we expect groups to be organized in other cities and towns until our organization is as well known as that of the Sea Scouts and Boy Scouts."

The Air Scouts will become proficient in construction work on aeroplanes, or in other words, will be trained in aviation ground work and mechanics.

The young man has had this scheme in his mind for a long time. He has talked with many of the officers at Langley Field about it and they have given him encouragement, among them Licensed Pilots Mays, Wood and Powell.

Major Stewart, of Fort Monroe, has advised the young man to start such a movement, and has assured him of the major's support. He has won praise for his plan locally also.

Young Wright has invented several mechanical devices and among them a folding box kite. He has made several areoplanes modeled after planes now in use. They all fly. They have been exhibited in army camps and in scout meetings in Newport News.

In speaking of young Wright, R. E. Gourlie, scout executive, said:

"Dashiell Wright is one of our best scouts. He has a number of merit badges, among them one for aviation. He has built a number of aeroplane models and has demonstrated several flights before the Court of Honor. He has an inventive mind and I take pleasure in endorsing him. He is a good scout."

All Model Clubs, scouts, scoutmasters and others interested are requested to get in touch with Major S. T. Stewart, Fortress Monroe, or Dashiell Wright, Patrol Leader, Troop No. 1, Boy Scouts, 129 31st St., Newport News, Virginia.

A Scale Model of the Thomas-Morse Scout

A carefully planned scale model of a Thomas-Morse S4-C Secondary Training Scout plane has been constructed by Walter W. Fitch, 140 Howell Street, Canandaigua, N. Y. Although he is but fifteen years old, the fine workmanship and regard for good proportions shown in this model is an evidence of his skill and interest in aeronautics.

The general dimensions are:

Span (upper wing)	20 inches
Span (lower wing)	19 inches
Chord (upper wing)	4¼ inches
Chord (lower wing)	3¾ inches
Gap between wings	3½ inches
Stagger	1 inch

The wings are cut of solid pieces of Cypress covered with cloth, varnished and painted the khaki color used by the Army Air Service.

Control horns on the elevators are of veneer.

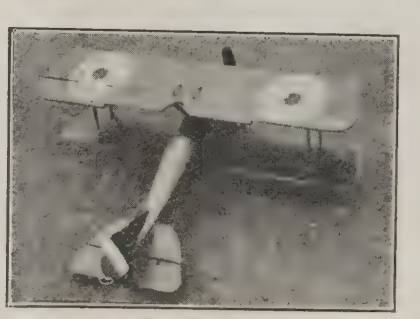
The body is also cloth-covered, to give the appearance of reality. It is built up of white wood. An aluminum seat is placed in the cockpit; a control stick is located in front of it, but difficulty was encountered in making it operate properly. A windshield is placed ahead of the cockpit.

Aileron control pylons are made of copper wire.

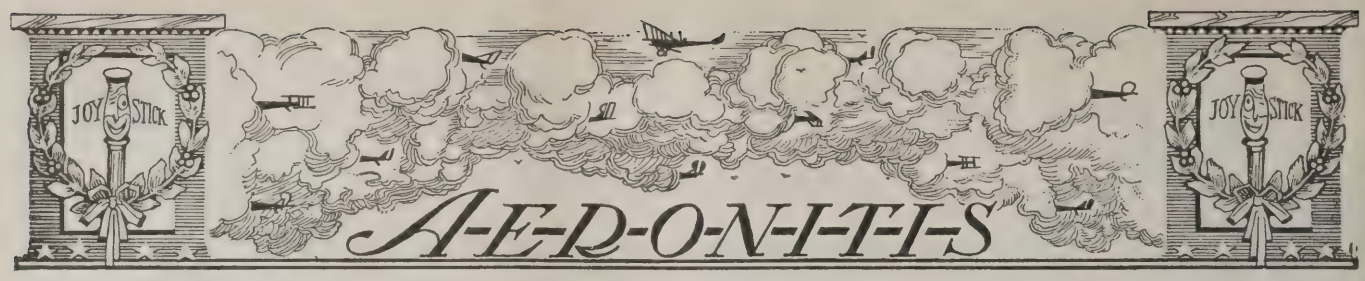
A piece of metal projects down for the tail-skid just as on the full-sized plane.

The propeller is carved from a piece of redwood.

Mr. Fitch is anxious to get into communication with other "aviation fans" whose interests are along similar lines of endeavor.



A 20-inch scale model of the Thomas-Morse S4-C Scout Aeroplane



To the Aviator

Far, far aloft majestically thou glidest,
A valiant wanderer through azure depths of space.
Some craggy, sunny Ithaca perchance thou seekest,
Where 'mong the clouds they're watching for thy dauntless face.

O'er what vast reaches hast thou ploughed thy way?
What cities seen enskied? What haunts of men diverse?
Defying hoary gods, not heeding what they say,
Though buffeted by tempest, tossed by winds adverse?

Have joyous dolphins played about thy churning prow?
Hast thou been lured by smiling sirens of the sky?
Canst thou escape the wiles of cunning Circe now,
And free thy mates who wallow in her stinking sty?

As one who's left for aye thy landings here below,
Thou sail'st o'er us who live on earthly levels bare;
Kin thou to those intrepid voyagers of long ago,
As vanquished they the sea thou makest conquest of the air.

He who in beginning gave to man in love
O'er all the teeming earth and fruitful sea so vast
Dominion, o'er these silent realms above,
To him now gladly gives supreme control at last.

Night falls apace and hides thee from our wondering gaze,
But we'll not grope and stumble on as those bereft
While threading the winding paths of this our earthly maze,
For we with courage new and larger faith are left.

Kelly Field, Texas. EDWARD DAY.

Poor Mary

Oh Mary had an airplane,
With shining wing and rod
And she said that she would drive it—
She wouldn't be a clod.

She pushed herself into it,
Completely dressed and shod
And somewhere in the cockpit
She gave the thing a prod.

She pushed a little lever and
With a little nod
She left our terra firma
For upper ways introd.

She pushed another lever
When she found it acting odd
And now she's pushing daisies
From the cemetery sod.

My Bonnie

My Bonnie went down to the cellar,
A leaking gas pipe he would see,
He lighted a match for to find it,
Oh bring back my Bonnie to me!

My Bonnie goes down to the cellar,
Quite often, alack and alas!
He comes back a different feller,
But he doesn't get lit up on gas!

Father was standing before the fire and lecturing to his son and heir on the necessity for thinking twice before speaking.

"Father" exclaimed the boy.

"Think twice, my son," admonished Father.

The boy pondered for two minutes, and then said: "Father, I have thought twice and I am quite convinced that your coat tails are on fire."

Tramp: Please, Mr., give me a dime for some bread?

Gentleman: Can't you go into any business that is more profitable than this?

Tramp: I'd like to open a bank if I could only get the tools.

Minister—Now, Uncle Ephraim, do you think you're doing right to leave your wife at the washtub while you go off fishing?

Ephraim—Suttingly, sah; mah wife kin be trusted, she kin; she wuks jes ez hahd when I'm away ez when Ize a watchin' of her, she do.

C. P. O. at morning quarters—"Put your hat on square on your head. You don't see me going around with my hat on the the back of my head, do you?"

Boot—"No, but you've got an anchor to hold yours down." —*California Cub.*

Making Good

She said
She would
Go through anything
With me,
So she started
On my
Bank account.
—*Pitt Panther.*

Hints for Dancers

1. If punch is served, don't allow the ladies to crowd you away from the bowl.
2. In making an approach on the bowl, knock everybody down who gets in your way.
3. If by mistake a lady happens to get within reaching distance of those serving, try to spill a glass or two on her gown so she'll have better manners next time.
4. Move alongside the bowl and mop up about eight or ten glassfuls as soon as you can.
5. If the floor is crowded make all the speed you can while dancing. Thirty-five knots is the latest standard speed.
6. Do all the fancy steps you know. If you think of some you want to try now is your chance. It is bad form not to walk on other people's feet while doing this.
7. If some bird wants to introduce you to his girl make him bring her over to where you are standing.
8. After you have engaged a dance with her, tell her where she can find you when the dance starts.
9. When the orchestra plays a tune you know, either whistle or sing the chorus. Your partner has never heard it before.
10. Don't forget to take a couple of packages of chewing gum with you to the dance. When you have finished chewing your gum drop it in the middle of the deck. This tends to improve the floor and those dancing will appreciate your efforts.—*Sub Base Ballast.*

An aviation machinist mate took his girl to dinner the other evening and when he said "Will you have a little shrimp?" she replied, "Oh, this is so sudden!"

Automobiles we like to ride in,
But to stroll on foot is better,
If a maid is strolling with us,
And we truly hope to get her;
But in nineteen twenty-one wooing
BUICK'S seem to be in style,
On the cushions billing, loving,
You'll find Loupos all the while.

"Yes, ma'am," said Mary, "I'm going to leave you. I don't like that snip of a dude that calls on Miss Mabel."

"The idea!" exclaimed the Norfolk lady; "he doesn't call to see you, so what"—. I know he don't, ma'am; but I'm afraid one o' the neighbors might think he does."

Captain: "Young man, I've had my eye on you for some time and—"

Private: "I'm quittin' y' can't fire me."

Mr. Blue: How would you like to have me for your second husband?

Mrs. Gray: Go on with you! Wait 'till I'm a widow before you ask me.

Mr. Blue: Well, you are one. Gray was just run over by an automobile.

...ERSITY OF ILLINOIS LIBRARY
JAN 4 1922

AERIAL AGE WEEKLY

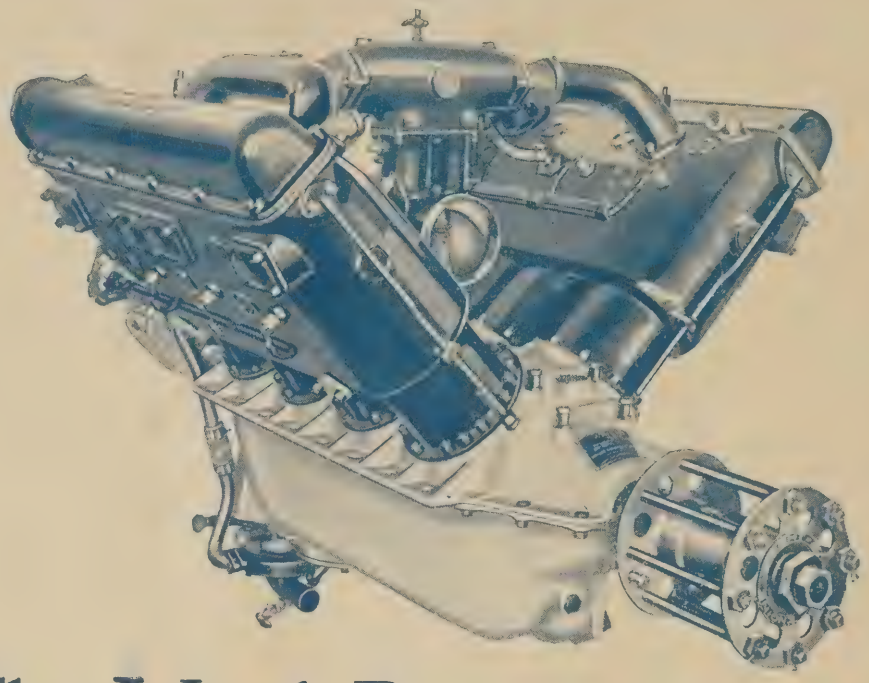
VOL. 14. No. 18 JANUARY 9, 1922 10 CENTS A COPY



All Aboard!

Larsen Plane Establishes World's Endurance Record

...ISHED WEEKLY BY THE AERIAL AGE ...MPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
...riptions: Domestic, $4; Foreign, $6. Ente... ...cond-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



The Vital Requirements of Pursuit Engines

The non-production of pursuit aviation engines in this country during the war was largely due to the lack of experience in this field.

Just prior to the armistice, however, the three-year development work of this Company on pursuit types culminated in the development for production of the 300 horse power Wright Engine.

When this Company determined that the manufacture of aeronautical engines was to be its sole aim, it determined also to concentrate first upon a pursuit type which would have no superior and, if possible, no equal, principally because its experience had proven that the pursuit type is the first line of aerial defense. With the entire personnel of this Company working toward this end the development of

THE WRIGHT PURSUIT ENGINE

The Standard Pursuit Engine of the U. S.

has been accomplished and meets, beyond all question, the vital requirements of the pursuit type; first, minimum weight per horse power, second, compactness, third, reliability, fourth, interchangeability.

The fullest measure of this development is expressed in the Wright Model H—3 Engine, official tests of which are a matter of record.



"The Identification of Incomparable Service"

WRIGHT AERONAUTICAL CORPORATION, *Paterson, N. J., U. S. A.*

WRIGHT

PURSUIT ENGINES

THE STANDARD PURSUIT ENGINE OF THE UNITED STATES

January 9, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 18

TABLE OF CONTENTS

The Press on the Larsen Achievement 411
The News of the Week 412
Calendar of Coming Events..... 412
Larsen Plane Establishes World's Endurance Record 413
The Aircraft Trade Review 414
Aircraft Industry Organizes Chamber of Commerce to Popularize Travel by Air 415
Air Photos to Aid City Development 416
The Choice of Wing Sections for Aeroplanes 417
Dayton Wright Model FP-2 Seaplane 420
A Mechanical Device for Illustrating Aeroplane Stability 421
Cost Figures on Operating Aeromarine Flying Boat Passenger and Mail Service 422
Naval and Military Aeronautics.... 423
Foreign News 424
Elementary Aeronautics and Model Notes 425
Aeronitis 426

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

This Pilot says:
"I have flown the Lincoln Standard over four States and consider it the best ship on the market. Its ability in tight places is wonderful."

Price $3985
F. O. B. Factory

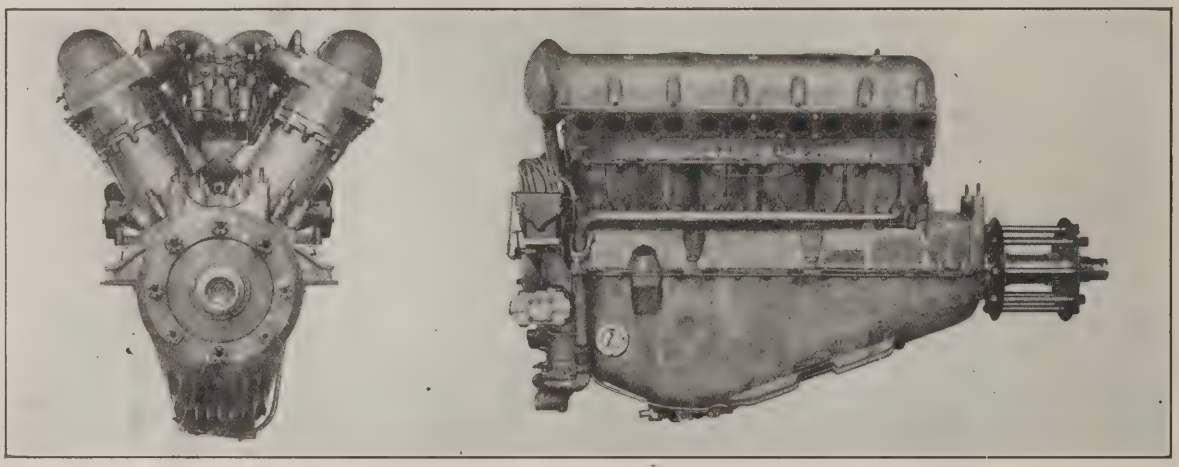


Ted LeCocq, Pilot (at left)
D. Swanson, Mechanic
Flying Lincoln Standard Speedster

"Man-O-War"
Owned by Mr. Collins of
Collins Oil Co., Knoxville, Ia.

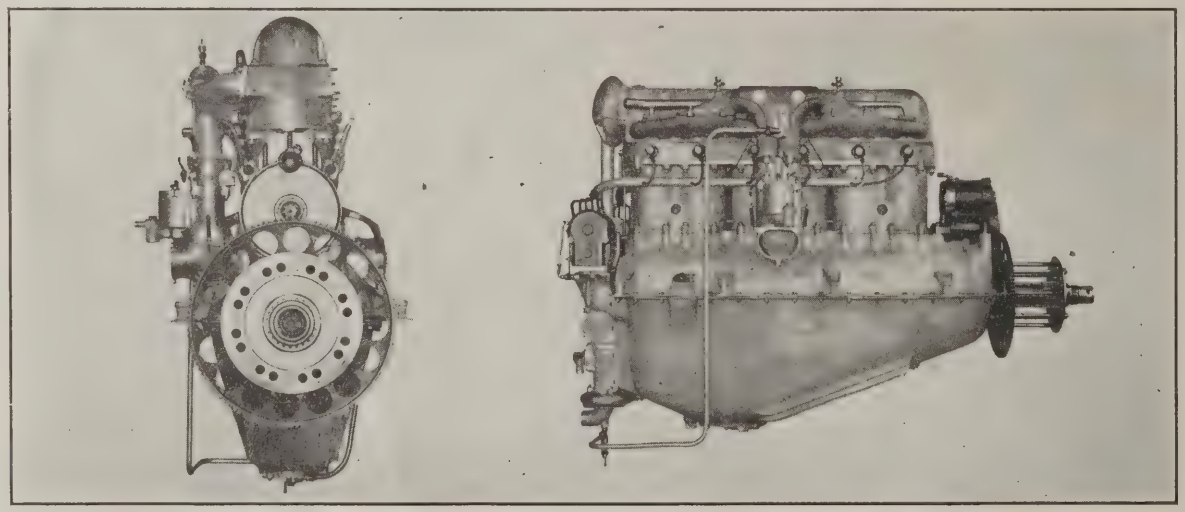
NEBRASKA AIRCRAFT CORP.
Lincoln, Nebraska

Curtiss



"CURTISS" MODEL CD-12 AVIATION ENGINE

Number of cylinders	12	Weight dry but complete	700 lbs.
Arrangement and angle of cylinders	60° vee	Weight of jacket water	38 lbs.
Water or air cooling	Water	Piston displacement	1145 cu. in.
Bore	4½ in.	Brake M.E.P. per sq. in.	135 lbs.
Stroke	6 in.	Compression ratio	5.7:1
Brake Horse Power	385	INSTALLATION DIMENSIONS:	
RPM of crankshaft above BHP	2000	Overall length	58⅛ in.
Reduction gear ratio	Direct Drive	Overall height	37½ in.
Gasoline per hour	32.1 gals.	Overall width	28¼ in.
Gasoline per BHP hour	.50 lbs.	Height above engine bed	21½ in.
Oil per BHP hour	.015 lbs.	Thickness of engine bed	1½ in.



"CURTISS" MODEL C-6-A AVIATION ENGINE

Number of cylinders	6	Weight dry but complete	420 lbs.
Arrangement and angle of cylinders	Vertical	Weight of jacket water	19 lbs.
Water or air cooling	Water	Piston displacement	572.5 cu. in.
Bore	4½ in.	Brake M.E.P. per sq. in.	128 lbs.
Stroke	6 in.	Compression ratio	5.2:1
Brake Horse Power	160	INSTALLATION DIMENSIONS:	
RPM of crankshaft above BHP	1750	Overall length	57 19/32 in.
Reduction gear ratio	Direct Drive	Overall height	40¾ in.
Gasoline per hour	13 1/3 gals.	Overall width	23 3/32 in.
Gasoline per BHP hour	.50 lbs.	Height above engine bed	24 11/32 in.
Oil per BHP hour	.015 lbs.	Thickness of engine bed	1½ in.

CURTISS AEROPLANE & MOTOR CORPORATION

Garden City, Long Island, New York

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., January 9, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, JANUARY 9, 1922 No. 18

THE PRESS ON THE LARSEN ACHIEVEMENT

THE remarkable continuous flight of twenty-six hours, nineteen minutes and thirty-five seconds made by pilots Stinson and Bertaud in the JL-6 all-metal monoplane under very bad weather conditions did more than to transfer to America another hard won world's record in aviation. It brings forcibly to the public mind the marvelous development of aerial transport, its security and its possibilities of performance.

The machine was specially designed for commercial transport after the war. It is equipped with a limousine cabin designed to carry six passengers in comfort. Throughout the twenty-six hours it circled around the bleak plains of Long Island, at times against a terrific gale, the machine covered approximately a distance of 2,600 miles. With the wind behind it it would have flown from this city to Berlin and under normal conditions would have made London easily. When it alighted there was still sufficient fuel to have kept the machine in the air another seven hours. During the continuous flight of twenty-six hours two extra passengers could have been carried safely.

The conditions under which the memorable flight was made again emphasize the caliber of American aviators. Just before victory was in sight, when the feed line from one of the emergency oil tanks broke and threatened to put an end to the attempt, Stinson removed his gauntlet in a temperature several degrees below zero and broke a hole in the emergency tank. This accomplished, he inserted a rubber hose and siphoned oil into the main tank. This act made the record possible, though it may cost Stinson three of his fingers from frostbite. That this repair was possible while in the air suggests how safe flying is becoming.

The flight itself is an answer to the oft repeated query, "What is the use of it?" From it invaluable data on engine performance, stresses and strains on the metal structure during severe weather and flying conditions generally have been gained that will have much to do with future design. Stinson and his companion not only added two full hours to the world's duration record, but they did it in winter, whereas the record they eclipsed was made in France in summer.

All honor to them!

Their success brings to this country the fourth world's record in aviation this year. On September 28, Lieutenant McCready established a world's altitude record by rising 37,800 feet above sea level. In November Bert Acosta established a world's speed record around a closed circuit by flying 150 miles at an average speed of 176.7 miles an hour, and in August, Lieutenant McCullough established a world's altitude record for seaplanes by ascending 19,500 feet.

The only outstanding world's record in aviation now held in any other country is that of straightaway speed over a measured course. This is held in France, and to eclipse it some American machine will be compelled to fly upward of 210 miles an hour, but American manufacturers are confident they will do it early in the coming year.—*Editorial in N. Y. Tribune.*

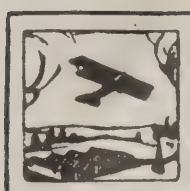
The most important aspect of the achievement is its bearing on commercial flying. Of course, distance flying and endurance flying are somewhat different affairs, yet the possibility of a day's flying in the one case has a direct application to the other. The lengthening of the endurance record means a strong possibility of lengthening the distance record. The lengthening of the distance record means, under present conditions, the ability to carry a larger fuel supply than ever before. This has in turn a relation to carrying capacity per horsepower unit. The Larsen record was not only an indication of the ability of aircraft to fly further than ever before, but also of their ability to take larger and larger loads, an important aspect of their development as commercial carriers.

—*N. Y. Globe.*

The exploit of the American aviators who beat the world's endurance record is more than a personal triumph. It shows the advance of flying in its most necessary department, for the quality more desirable than any other in planes is staying power.

When Alcock and Brown hopped the Atlantic they did the 2,000 miles in 16 hours, or 125 miles an hour. If Stinson and Bertaud had been flying eastward at this rate, instead of hovering over the Mineola Field, they could have gone from Long Island to Gibraltar in the 26 hours and 19 minutes that they were aloft.

The record breaking performance is thoroughly American in men and machinery. It beats the nearest European performance by two hours. It is the kind of aerial feat that is worth doing.—*N. Y. Herald.*



THE NEWS OF THE WEEK



No Ford Planes Immediately

A high official of the Ford Motor Company in Detroit, writing a party in New York, says: "Relative to the reports you mention about Mr. Ford bringing out an aeroplane-seaplane and possibly an airship, would say, that while he is considerably interested in this subject, there is no truth in the reports that he will become actively engaged in this line in the near future."

Some Fast Traveling in the Aerial Mail Service

Pilot Claire K. Vance of the Aerial Mail Service must have surely had some wind on the tail of his plane when, on November 21st he made the trip to Elko, Nevada, from Reno, Nevada, a distance of some 235 miles, in one hour and twenty minutes. There have been hints cast that Vance was a speed demon, and now it goes without saying.

To Increase Activities of Aerial Mail Service

Mr. Glenn L. Martin, of the Glenn L. Martin Co., Cleveland, Ohio, and Assistant Postmaster Shaunessey are expected at Crissy Field, Presidio of San Francisco, Cal., in the near future for a conference with Major H. H. Arnold, 9th Corps Area Air Officer, and other army officials. Much is looked for as a result of their conference in furthering the activities of the Aerial Mail Service and as a stimulant to the number of civilian flyers in the Bay region of San Francisco.

Aero Club of Minneapolis

The first issue of *Contact,* the official bulletin of the Aero Club of Minneapolis, is before us, and we congratulate the officers in getting out this medium of coordinating the information of its members.

The present officers of the Club are as follows:

R. R. Rand, Jr., President; Wm. F. Brooks, Vice President; Harry C. Piper, Treasurer; Paul Goldsborough, Secretary.

Directors: Wm. F. Brooks, John P. Snyder, Joseph Chapman, R. R. Rand, Jr., Matthew D. Crawford, Ray S. Miller, Murray K. Guthrie, V. F. Rotering, Glenn Traer, Charles S. Pillsbury, Isaac Hazlett, Guy A. Thomas, Paul W. Latham, F. B. Hubachek, R. G. Browning, Harry C. Piper, Lawrence W. Carpenter, Philip J. Barnes, H. M. Gardner, Earle Brown, F. A. Chamberlain, D. Draper Dayton, Vincent G. Dodds, Mark M. Hurd, Weldon Larrabee, R. G. Robertson, Douglas K. Kennedy, C. T. A. Hart, Rockwood W. Bullard.

Sioux City to Have First Corps Area Air Caucus

The aviation convention of the states comprising the ninth army corps area will be assembled in Sioux City on January 26th and 27th for the purpose of completing city, district and state air associations throughout the entire corps area. Delegates from each city, district and state will be in attendance, as well as officers of the National Air Association. Several men of national prominence in air navigation development are expected to be in Sioux City to take active part in the organization work, including H. E. Coffin, E. V. Rickenbacker, J. G. Vincent, Sidney D. Waldron, Col. E. H. Shaughnessy, Benedict Crowell, David Beecroft and E. A. Kelly. The convention is called and will be conducted under the jurisdiction of Rufus R. Rand of Minneapolis and John B. Coleman of Sioux City, who represent the corps area on the National Board of Governors. The committee in charge of preparations are C. B. Toy, J. L. Mitchell, C. B. Beck, E. R. Schultz, A. S. Johnson, E. C. Epely, Stanley G. Eaton, Ralph Oliver, Wilson Clark and John H. Kelly. Announcement of other committees will be made later.

The adoption of the slogan, "Air Navigation" will be featured at the convention, and among the exhibitions of great interest will be the motion pictures taken by the Government of the bombing demonstration off of Muscle Shoals, Alabama.

This convention is the first of its kind and is expected to be followed by corps area conventions throughout the entire United States.

Lack of Interest in Aviation Around New York Traced to Its Source

In preparing the aviation program for 1922, the Contest Committee of the Aero Club of America made an analysis of the aviation meets held in 1921 and found that in spite of the Secretary of War's order which reduced Government participation in aviation contests to practically nil, there were meets held in the following places: Kansas City, Omaha, Baltimore, Chicago, Kokomo, Ind., Dallas, Denver, Oakland and Long Beach, California, also in several cities in Iowa and one in Florida, supported almost entirely by privately owned planes.

In order to more intelligently direct the contest for 1922, the committee has been appealing, through the medium of aviation magazines, to the owners of aircraft to register. This request first appeared over a month ago, and since that time replies have been received from Massachusetts to Seattle, Washington, and from Southern California to Florida, but not one from a single aviation company around New York City, although there are at least twenty in this district, supposedly in the business of merchandising aircraft.

When the Pulitzer Trophy Race was held on Long Island in 1920, there was but one company which made entry and that was a foreign make of airplane, all other entries being made by the Government.

In view of this situation, the Contest Committee of the Aero Club of America does not see its way clear at this time to attempt to organize a meet in the vicinity of New York, without the knowledge of the number and types of aeroplanes available in that district, and in making this announcement suggests that the President and Board of Directors of the Aircraft Companies in the Metropolitan District give some thought to the merchandising efficiency of their organizations, as compared to that of other lines of business with which they may be associated.

CALEB S. BRAGG,
Chairman Contest Committee.

CALENDAR OF COMING EVENTS
under sanction of
AERO CLUB OF AMERICA

Annual Banquet Aero Club of America
Hotel Commodore, New York City,
7:30 Monday Evening, January 9, 1922
For members (who are entitled to bring guests) of
Aero Club of America, and affiliated Aero Clubs
Society of Automotive Engineers
Automobile Club of America
Automobile Club of New York
Motor Boat Club of America
New York Yacht Club
Tickets: $8.00

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)
In Preparation by the Aero Club of America
American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th
First Annual Interservice Championship Meet
Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurthe
Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

LARSEN PLANE ESTABLISHES WORLD'S ENDURANCE RECORD

FLYING continuously for 26 hours, 19 minutes and 35 seconds in gales, snow and a zero temperature, Edward Stinson and Lloyd Bertaud in a Larsen all-metal monoplane at Roosevelt Field, near Mineola, L. I., set a new world's record December 30, for sustained flight in a heavier-than-air machine. Averaging 85 miles an hour in circling above the flying field and surrounding country, the monoplane traveled at least 2,200 miles, or, translated into land distance, the equivalent of the Pacific gap between California and Hawaii.

Had the plane flown straightaway the pilots would have landed in Reno, Nev. The feat was all the more remarkable when it is compared with the previous endurance record of 24 hours, 19 minutes and 2 seconds made in France by Lucien Boussoutroy and Jean Bernard. Their flight was made on a clear day in June of last year after careful preparation. Stinson and Bertaud agreed to make the attempt for J. L. Larsen, designer of the plane, the day before the start of the flight.

Numb with cold and exhausted by lack of sleep, Stinson and Bertaud brought the monoplane down to earth at 11:17:50 o'clock A. M. December 30, They both maintained that they would have remained up several hours longer had they not been forced to descend by reason of a faulty oil connection with which they had been struggling since 3 o'clock in the morning.

Taxied Back to Hangar

When the J. L.-6, landed in the middle of Roosevelt Field within a few feet from where it took off the day before, Mr. Larsen, who had maintained a constant vigil, started out in his automobile to bring the two aviators to the hangars a quarter of a mile back, but Stinson and Bertaud stuck to their posts and "taxied" the plane to the hangar.

Both fliers were almost blinded by oil. Stinson staggered as he alighted, but Bertaud was able to muster up a grin for the army of photographers. Stinson had not left his seat in the open cockpit of the plane since 4 o'clock Thursday afternoon and Bertaud had found little time to enjoy the comfort of the limousine interior of the plane back of the pilot's seat. For the time both men were stone deaf.

"It's good to be able to walk again," said Stinson. "I'm nearly frozen. We could have staid up until dark. Too much oil; that was the trouble." Stinson held up his right hand. "Three fingers frozen!" he yelled at the top of his lungs. "One finger frozen on the other hand too. I'm going home to bed. I feel as if I would never get warm again."

Bertaud fared better, but he agreed that the cold had been "terrific." He too, expressed a desire to sleep, though he related his experience before leaving the field. Mrs. Stinson was on hand to greet her husband, and brought sandwiches, but "Eddie," as he is known to hundreds of army aviators whom he trained during the war, was too tired to eat. He left at once for his home in Hempstead. Describing the flight to newspaper men, Bertaud said:

"Our first four hours in the air yesterday were flown between fifty and seventy feet above the ground. The snowstorm raging then was so heavy that we could not go any higher and see the earth. We had to dodge church spires and chimneys frequently. Once when I was piloting the machine we almost hit the old chimney of the Camp Mills Hospital.

"Stinson and I did not do much talking until after we found we had been flying over twenty-five hours and knew that we had beaten the world's record. We both turned around in our seats and shook hands with each other.

"We encountered our first difficulty about 2 o'clock this morning, when the oil from the auxiliary tank began to thicken from the cold and would not feed well. We discussed the question as to whether we should land. We decided not to quit as long as the plane would remain in the air. We hit upon the plan of pouring the oil into the tank and not depending on the feed pipe.

Poured Oil in Tanks

"While one of us steered the other had to lift the five-gallon auxiliary oil cans, into which we had punched holes, in order to pour the heavy mixture into the tank. It was so thick that we could pour only about a quart at a time. Great care was required to keep the oil from running out, thereby burning out the bearings and destroying the motor. Incidentally, our hands, which had become numb just before midnight, got back some of their feeling with this strenuous work.

"Flying around and around the country was monotonous, especially after darkness set in. The fatigue from the cold was terrible. We did not dare to go to sleep for fear that we would become so chilled and numbed that when we awoke we would not be able to handle the plane. We had to maintain a constant vigil to keep the plane at an altitude where it would consume the least amount of gasoline.

"When we started on the flight the motor was turning up 1,400 revolutions per minute and when we landed it was 1,075 per minute. The motor under ordinary circumstances will consume about seventeen gallons of gasoline an hour. With the engine throttled down we used about twelve. The principal factors in a test of this kind are reliability, economy and good handling. During the night we never flew out of sight of the night flares at Roosevelt Field and Larsen Field, at Central Park, L. I. Sometimes during the long hours of the night we hovered over Freeport to vary the monotony.

"I have never flown more than twelve continuous hours before and I doubt if Stinson has. I do not care to try it again under such adverse weather conditions as we had on this occasion."

Ate Nothing in Flight

Bertaud said that neither he nor Stinson had eaten any of the food that they had taken along with them on the trip. They each drank a little hot coffee during the flight, he said. The J. L.-6 "took off" from Roosevelt Field at 8:58:15 on December 29 in a driving snowstorm. The two pilots took no particular precautions to protect themselves against the blustery weather, depending for warmth while in the air on a special heating arrangement in the cockpit, which led into the spacious interior compartment which had been fitted up comfortably with a bed.

Stinson wore a sweater and flying coat over a khaki uniform, while Bertaud was attired in a civilian suit and leather coat. The plane carried 2.200 pounds of gasoline and a gross load of about 5,300 pounds.

Seven judges appointed by the Contest Committee of the Aero Club of America acted as starters and watchers of the flight, working throughout the day and night in two-hour shifts. The judges were H. G. Scholler, W. M. Royse, H. G. Davison, L. Balch, R. B. Uber, Earl Holtham and H. Sushan.

In a shack heated by three oil stoves the judges watched the plane perform its endless encirclings. At nightfall three flares were lighted and kept burning until daylight to guide the airmen. At 9:20 yesterday morning the aviators had broken the world's record, but Stinson and Bertaud gave no indication of coming down. From that moment on it was simply an attempt to hang up a new endurance record.

American Made Throughout

J. L. Larsen, owner and designer of the monoplane, who has flown more than 300,000 miles in this country and Europe in J. L.-6's, said that in a sister plane of the one used yesterday he had traveled by air from the southern part of Mexico to within two hours' air distance of the Arctic Ocean and from Boston to San Francisco. "And the plane is all American made," he said. "Made in America by American workmen andof American material. I am happy to know that I have been able to capture another aeronautical record for the United States."

Mr. Larsen said he flew the record winner recently to the air meets at Kansas City and Omaha. The plane, constructed of duralumin throughout, has a wing span of fifty feet and a length over all of thirty-one feet. It stands eleven feet high. It is motored with a 185 horsepower B. M. E. engine and has an enclosed cabin seating six persons. Major Gen. Mason Patrick, Chief of the United States Air Service, sent a congratulatory message to Stinson last night.

"The Army Air Service," he said, "is pleased to extend to a former member its congratulations on the remarkable duration record just attained by you."

Augustus Post, Executive Secretary of the Aero Club of America, said the feat was but another demonstration of the possibilities of the aeroplane as a carrier of commerce. One did not have to look very far into the future to picture nonstop flights between New York and Chicago and other cities as a common every day occurance. The Aeronautical Chamber of Commerce, commenting on the flight in a statement said:

Fourth U. S. Record This Year

"This record, which is the fourth world's record to be achieved by America in 1921, focuses attention on the last day of the year to the great achievements in American flying. Eighteen years ago this month the world's first flight was made in an American machine, the duration being fifty-nine seconds—an unheard of accomplishment. In those fifty-nine seconds Orville Wright covered a distance of 852 feet. The other world's records made by America during the year were:

Altitude—Lieutenant J. A. McCready, U. S. A. S., on September 28, reached a height of 37,800 feet over McCook Field, Dayton, Ohio, in a Lepere biplane.

Speed—Bert Acosta, in a Curtiss-Navy Racer, flew at a speed of 176.7 miles an hour for 150 miles during the Pulitzer race at Omaha, Neb., November 3.

Efficiency—The Loening monoplane flying yacht, on August 16, reached a height of 19,500 feet with four persons over Port Washington, L. I., N. Y.

(*Concluded on page* 414)

The AIRCRAFT TRADE REVIEW

New Farman Sport Plane Shows Remarkable Performance

During the past week the personnel at Bolling Field were privileged to witness a sensational demonstration of the new Farman Sport Plane, piloted by former Captain Robertson of the Royal Air Force. This is the plane which created such a furore in aviation circles by its performance at Omaha. This tiny biplane, equipped with a 60 h. p. LeRhone motor, with a wing span of only 24 feet and a total weight of less than five hundred pounds, showed something new in range of speed, and goes far toward filling the need of a plane that can land and take off almost anywhere, besides being speedy and maneuverable. The maximum speed of this little fellow is rated at more than 90 miles per hour, and its normal speed ranges down to a landing speed of between 10 and 20 miles per hour, depending upon the wind. On this field, against a 12-mile wind, it landed in less than 50 feet, and took off in less than 60 feet, climbing at an angle of more than 45 degrees. Its maneuverability is unexcelled by anything ever seen at Bolling Field, and yet it cannot be made to spin. Its performance convinced everyone at the field that a real step forward had been made in the onward march of aviation.

West Virginia Field

A rectangular landing field 900 by 200 feet is located 1½ miles south of Charleston, near and parallel to the Kanawha River, long axis northwest-southeast.

The field contains a hangar and is marked with a "*T*." Prevailing winds are from the southeast. High voltage telephone lines follow the road on the north side. In event of landing with too much speed it is possible to roll over the road to the southeast.

Colorado Landing Field

An emergency landing field has been established at Englewood, Colo., 4 miles south of Denver; the field is owned by Mr. J. M. Haldeman.

The field contains 80 acres with long axis north-south. The land is rolling, well drained, and free from trees.

A wire fence incloses the north, east, and south sides; telephone wire along the road on the north and east sides.

The altitude of Englewood is 500 feet.

Prevailing wind, southwest.

Gas and oil may be procured either from Denver or Littleton, both four miles distant.

Plan Air Line to Chicago

Daily passenger and freight aeroplane service between New York and Chicago in competition with railroads will be inaugurated as soon as planes can be completed, according to an announcement made by the Seaboard Consolidated Airlines, Inc., of 110 West Fortieth Street, of which Stanley E. Hubbard is President. One of the eight-passenger planes to be used has been completed, while the construction of others will be started immediately, it was said.

Details of the service have been worked out by aeronautical engineers who have studied the airlines of Germany and France. Airways to Pittsburgh, Cleveland, Albany and Montreal will also be developed. The time table calls for three trips daily each way to Chicago on an eight-hour schedule, with a rebate of $1 for every minute of delay.

The fare to Chicago will be $51.80, to Pittsburgh $20.30, and to Montreal $20; baggage limit, ten pounds. The planes will also carry 1,000 pounds of freight each at $1 a pound, according to Mr. Hubbard.

Forest Service Conference at Mather Field

A big Forest Service conference was held at Mather Field, Mills, Cal., during the latter part of November, which was attended by approximately fifty of the leading members of that service. The representatives from the National Headquarters were Chief Forester W. B. Greeley, with Messrs. R. Headley, Assistant Forester; E. W. Kelley, Fire Inspector; and C. E. Rachford, Grazing Inspector. District Foresters Fred Morrell from Missoula, Montana; A. S. Peck, Denver, Colo.; F. C. W. Pooler, Albuquerque, N. M.; R. H. Rutledge, Ogden, Utah; and Paul G. Redington, San Francisco, Cal., were present with their forest supervisors, fire specialists, rangers, law enforcement specialists, chiefs of operation, fire assistants and the administrative assistants; men in charge of personnel and training; and men who look after public relations and make a specialty of research work in the interests of fire prevention.

A lengthy program was originally planned, but the important questions involved were so numerous that it was found necessary to hold sessions every evening as well as in the mornings and afternoons of each day, causing a considerable curtailment of the hospitality planned to be extended to the Forestry Service by the Command at Mather Field in the matter of social affairs.

In addition to the Federal Forestry representatives there were present Messrs. D. R. Cameron, Forest Inspector of British Columbia; Don Bruce, Professor of the University of California, and M. B. Pratt, Deputy State Forester of California.

The conference was brought to a close on November 26th and, although some of the members left earlier in the week, the majority remained until Saturday afternoon, when the few who had brought their cars started on motor trips home to San Francisco and points in Oregon and New Mexico, the balance leaving by train. The lecture delivered during the week by Mr. Paul G. Fair, Constructor of Exhibits of District No. 5, for the information of the foresters, was also attended by nearly everyone on the post. Aside from the entertainment afforded by the showing of attractively colored slides and the rather technical information given on the mounting of wild animals, many new ideas on the taking of photographs were gained. The conservation of animal life, is a part of the work of the Forestry Service, and Mr. Fair's talk was of practical help, or will be so, to many of the foresters when they get out in the field.

Mr. Fair's forestry exhibit at the Officers' Club has been a source of much interest and enjoyment to everyone. A harmonious background, painted, the foreground on the right burned off in a fire started by a lighted match carelessly thrown into dry brush, the middle area cleared by the forest rangers' work, thereby stopping the progress of the fire, and on the left side of the exhibit green trees, shrubs and bushes, making a safe retreat for the wild animals of the wood, together with two perfectly mounted specimens of young deer standing in the foreground, presented a very attractive picture. Many pictures taken by Mr. Fair, showing the cooperation between the Forestry and Air Services, have been hung in the club, temporarily, and excellently executed small models of campers with their properly equipped tent and correctly arranged camp fire have been erected.

The night before the foresters left they gave a stag party at the club to the officers of Mather Field, entertaining them with songs, recitations, impromptu speeches, etc. Clever cartoons, of both the foresters and officers, drawn by one of the former, occasioned much hilarity, but no wounded feelings. Refreshments were served during the entire entertainment, which did not break up until after twelve o'clock, and everyone attending pronounced the affair a huge success.

New Aerial Mail Hangar at Crissy Field

Mr. Caldwell, Air Mail Superintendent, has let the contract for a new hangar at Crissy Field. Work was begun on November 28th, and it is expected that construction will be completed and the hangar ready for occupancy in thirty days. The hangar now used by the Air Mail Service will be turned over for the use of the Reserve Squadrons now organizing in the vicinity of San Francisco.

(*Concluded from page* 413)

Stinson Trained Army Fliers

Edward Stinson and Lloyd Bertaud, both 27 years old, have long been identified with aeronautics. Stinson is credited with having trained more American fliers during the war than any other man. Barred from the army by reason of delicate health, he opened a field near San Antonio, Texas, as a civilian adjunct of the Air Service, and initiated the embryo airmen into the intricacies of "stunt" flying. When the war was over the Government awarded him a commission. As a "stunt" flier Stinson has few peers.

In his ten years' experience as an aviator he has never had a crash or broken any part of his plane. Stinson has two sisters, Catherine and Marjorie, who have made names for themselves as expert fliers.

Bertaud has had much experience as an aviator and instructor, and, piloting the plane used yesterday, he won the 140-mile American Legion Aerial Derby at Omaha in October.

AIRCRAFT INDUSTRY ORGANIZES CHAMBER OF COMMERCE TO POPULARIZE TRAVEL BY AIR

NEW YORK—Organization of the aircraft industry into a national body known as the Aeronautical Chamber of Commerce of America, with approximately 100 charter or founder members embracing the designing, constructing, operating and kindred elements, and representing virtually every section of the United States, was announced Dec. 30, at the Executive Offices, 501 Fifth Avenue. Among other things, it will develop the market and increase the use of flying machines among civilians, corporations and transportation companies.

The aircraft industry thus follows the example of all other modern industries which owe their present greatness in no small measure to the trade association. Organization of the Aeronautical Chamber of Commerce, following as it does the creation of the Bureau of Aeronautics in the Navy Department, and provision, in the Wadsworth-Hicks Bill, for a Commissioner of Civil Aviation in the Department of Commerce, and the nationalization and extension of the Aero Club of America, completes the accomplishments for the year and establishes the machinery whereby, it is believed, the development of American aviation will be greatly hastened.

The Aeronautical Chamber of Commerce of America is incorporated under the laws of the State of New York. Among its aims and purposes, as set forth in the Charter, are:

To foster, advance, promulgate, and promote trade and commerce, throughout the United States, its territories, possessions, and in foreign countries, in the interests of those persons, firms or corporations engaged in the business of manufacturing, buying, selling and dealing in aircraft, aircraft motors, and aircraft parts and accessories of every kind and nature.

To diffuse among its members accurate and reliable information as to the standing of its members and those persons, firms or corporations engaged in similar lines of business.

To procure uniformity and certainty in the customs and usages of trade and commerce among its members and those persons, firms or corporations having a common trade, business or professional interest in all matters pertaining to aeronautics.

To aid and assist in mapping out air roads and lanes; the location of landing fields, aerodromes, hangars, or such other structures as may be necessary for the advancement of aeronautics.

To advocate and promote in every lawful way the enactment of just and equitable laws . . . pertaining to aeronautics.

To settle, adjust and arbitrate any and all differences which may arise between its members, and persons, firms or corporations dealing with them.

To promote a more enlarged and friendly intercourse between its members, persons, firms and corporations engaged in the business of, or dealing in, aircraft, aircraft motors and aircraft parts and accessories, and generally to do every act and thing which may be necessary and proper for the advancement of the aeronautical art and industry and the accomplishment of the objects and purposes hereinbefore set forth; provided, however, that nothing herein contained shall authorize this corporation to engage in any business for pecuniary profit.

"The need for a central trade organization, including within its membership all of the responsible and permanent financial and professional interests in aviation in the country, has been felt for sometime," says a statement from the Aeronautical Chamber of Commerce. "The unsettled state of the industry, due at first to the tremendous burdens placed upon it in meeting the demands of wartime production, followed by the complete reorganization of the industry made necessary through the cessation of war contracts, has made it impracticable heretofore to bring this about.

"The existence of the Manufacturers Aircraft Association partly met the need. Its work has been characterized by a broad public-spirited attitude toward the entire industry and has been effective, but its members were the first to realize that an organization limited simply to manufacture aeroplanes, having, primarily, a common interest in the exchange of licenses for the use of patents, could not hope adequately to give representation to the entire field.

"After the Armistice, steps were taken to give consideration to the development of a broader and more inclusive body but, on account of the uncertainty of the future of many of the more important units in the industry, it appeared that the time was not opportune. A start was made, however, late in 1919, when Articles of Incorporation were issued. Following this, nothing definite was done beyond continuing the study of the situation and developing a general understanding and agreement relative to the details of such an organization. Study and consideration of these questions culminated a few weeks ago. At that time the plan was crystallized and submitted to representatives of all the various elements in the industry. It is now gratifying to be able to announce that the organization has been completed. Among its charter or founder members are found practically all of the responsible and representative men and organizations in this field. A glance at the list of members of the new organization will at once assure, it is believed, not only the successful future of the organization, but of its instant and important value of it to aviation and to the country.

"The new organization has taken over the offices and equipment of the Manufacturers Aircraft Association at 501 Fifth Avenue, New York City. The latter organization will continue to serve its members in handling the administration of the cross license agreement covering aeroplane patents. The Aeronautical Chamber of Commerce will assume and greatly extend all of the functions formerly handled by the older organization, including the collection and dissemination of information regarding aeronautical activities in this and other countries; the publication of the Aircraft Year Book; and the furnishing of special services to its members through its various department and committees.

"The new organization, including within its membership the principal constructors of aeroplanes and motors, as well as the manufacturers of accessories, instruments, materials and supplies, owners and operators of aircraft, various aeronautical trade papers and the principal engineers and designers, can be said to be truly representative of the aircraft art and industry in the United States.

"Aviation is a new and important element in our economic and social life and it is desirable that all of those having a permanent interest in the industry be thus brought together. Unification of interests in this important field will be of great significance, not only to the development of civil aviation but to the future security and general welfare of our country."

Among the founder or charter members are the following:

Aeromarine Airways, Inc., New York, Key West & Havana. By C. F. Redden, President.
Aeromarine Plane & Motor Company, Keyport, N. J. By I. M. Uppercu, President.
David Beecroft, New York. Directing Editor, Class Journal.
Luther K. Bell, New York. Of Manufacturers Aircraft Association, Inc.
L. W. Bettinger, New York. Of L. W. F. Engineering Company.
Bijur Motor Appliances Company, Hoboken, N. J. By Charles Marcus, Vice President.
Black, A. & D. R., New York. Aeronautical Engineers.
J. J. Boland, Keyport, N. J. Of Aeromarine Plane & Motor Company.
S. S. Bradley, New York. Of Manufacturers Aircraft Association, Inc.
Burnelli, Vincent J., Lindenhurst, L. I. Aeronautical Engineer.
John R. Cautley, Paterson, N. J. Of Wright Aeronautical Corporation.
A. J. Chalmers, New York. Publishers, Cine-Mundial.
Roland Chilton, Keyport, N. J. Of Aeromarine Plane & Motor Company.
Cox-Klemin Aircraft Corp., College Point, L. I. By Alexander Klemin.
Curtiss Aeroplane & Motor Corp., Garden City, L. I. By C. Roy Keys, Vice-President.
Curtiss Eastern Airplane Co., Philadelphia, Pa. By G. Sumner Ireland, President.
Glenn H. Curtiss, Garden City, L. I. Engineer.
Dayton Wright Company, Dayton, Ohio. By G. M. Williams, General Manager.
The Ralph C. Diggins Company, Chicago, Ill. By Ralph C. Diggins.
Donald Douglas, Los Angeles, California. Engineer.

The Douglas Company, Los Angeles, California. By Donald Douglas.
G. Elias & Bro., Inc., Buffalo, N. Y. By A. J. Elias, President.
Fairchild Aerial Camera Corp., New York. By Sherman Fairchild.
Sherman M. Fairchild, New York. Fairchild Aerial Camera Corp.
Albert H. Flint, College Point, L. I. Of L. W. F. Engineering Co.
A. J. Flochbar, College Point, L. I. Of L. W. F. Engineering Co.
Gallaudet Aircraft Corporation, East Greenwich, R. I. By J. K. Robinson, Jr., President.
Edson F. Gallaudet, East Greenwich, R. I. Engineer.
L. D. Gardner, New York. Publisher Aviation and Aircraft Journal.
W. L. Gilmore, Garden City, L. I. Curtiss Aeroplane & Motor Corp.
J. I. Hartness, College Point, L. I. L. W. F. Engineering Company.
Stewart Hartshorn Co., New York. By B. E. Bushnell, Sales Manager.
William Henry, Los Angeles, Calif. Of the Douglas Company.
George H. Houston, 60 Broadway, New York City.
G. Sumner Ireland, Philadelphia, Pa. Curtiss Eastern Airplane Corp.
Johnson Airplane & Supply Co., Dayton, O.
W. Wallace Kellett, Philadelphia, Pa. Representign H. & M. Farman.
C. Roy Keys, Garden City, L. I. Curtiss Aeroplane & Motor Corp.
E. M. Laird Company, Wichita, Kansas. E. M. Laird, President.
J. L. Aircraft Corp., New York. John M. Larson, President.
Lawrence Aero-Engine Corp. By Charles Lawrence, President.
W. B. Lebherz, East Greenwich, R. I. Of Gallaudet Aircraft Corp.
L. W. F. Engineering Co., College Point, L. I. A. H. Flint, Vice-President.
Lewis & Vought Corporation, Long Island City, L. I. By Chance M. Vought.
Alfred P. Loening, New York. Of Loening Aero. Eng. Corp.
Grover C. Loening, New York. Of Loening Aero. Eng. Corp.
Loening Aeronautical Engineering Corp., New York. By Grover C. Loening, President.
Manufacturers Aircraft Association, Inc., New York. By S. S. Bradley, General Manager.
Hamilton Maxwell, New York. Aerial Photography.
George Meade, Paterson, N. J. Of Wright Aeronautical Corp.
National Aircraft Underwriters Assn., New York. By Edmund Ely, President.
New Jersey Veneer Co., Paterson, N. J. By F. F. Perrine, Treasurer.
R. B. C. Noorduyn, New York. Of Netherlands Aircraft Corp.
Ordnance Engineering Corp., Baldwin, L. I. By E. R. Michie.
Packard Motor Car Company, Detroit, Mich.
Park Drop Forge Company, Cleveland, Ohio. By Fred L. Ball, Treasurer.
Pioneer Instrument Company, Brooklyn, N. Y. By Charles H. Colvin, President.
C. G. Peterson, Paterson, N. J. Of Wright Aeronautical Corp.
H. L. Pope, Paterson, N. J. Of Wright Aeronautical Corp.
Otto Praeger, New York. Aerial Transportation.
J. F. Prince, Paterson, N. J. Of Wright Aeronautical Corp.
C. F. Redden, New York. Of Aeromarine Airways.
H. J. Reilly, New York. Publisher, Army and Navy Journal.
F. B. Rentschler, Paterson, N. J. Of Wright Aeronautical Corp.
J. K. Robinson, Jr., New York. Of Gallaudet Aircraft Corp.
John M. Rogers, Paterson, N. J. Of Wright Aeronautical Corp.
Foster Russell Aviation Co., Spokane, Washington. By Foster Russell.
Frank H. Russell, Garden City, L. I. Of Curtiss Aeroplane & Motor Corp.
R. W. Schroeder, Chicago, Ill. Of Underwriters' Laboratories.
A. R. Small, Chicago, Ill. Of Underwriters' Laboratories.
Lawrence Sperry, Farmingdale, L. I. Of Lawrence Sperry Aircraft Corp.
Lawrence Sperry Aircraft Corp., Farmingdale, L. I. By Lawrence Sperry, President.
Stout Engineering Laboratories, Inc., Detroit, Mich. By William B. Stout, President.
J. P. Tarbox, Garden City, L. I. Of Curtiss Engineering Corp.
Robert G. Thach, New York, 120 Broadway.
Ralph Upson, New York. Engineer.
Valentine & Company, New York. By L. B. Valentine, Vice-President.
Adrian Van Muffling, New York. Aeronautical Engineer.
J. G. Vincent, Detroit, Michigan. Of Packard Motor Car Company.
Chance M. Vought, Long Island City, L. I. Of Lewis & Vought Corp.
G. Douglas Wardrop, New York. Editor, Aerial Age Weekly.
George S. Wheat, Paterson, N. J. Of Wright Aeronautical Corp.
G. M. Williams, Dayton, Ohio. Of Dayton Wright Company.
Wright Aeronautical Corporation, Paterson, N. J. By F. B. Rentschler, President.
W. W. Wyman, Chicago. Of C. L. Maguire Petroleum Co.
Paul Zimmerman, Keyport, N. J. Of Aeromarine Plane & Motor Co.
Henry M. Crane, New York City.
Thomas Morse Aircraft Corp., Ithaca, N. Y.
F. L. Moore, Ithaca.
Albert Champion, Champion Ignition Co., Flint, Mich.
Boeing Airplane Co., Seattle, Wash.
E. N. Gott, Seattle, Wash. Of the Boening Airplane Co.
I. M. Uppercu, New York. Of the Aeromarine Plane & Motor Co.
C. F. Kettering, Dayton, Ohio. Of the General Motors Corp.
W. B. Stout, Dayton, Ohio.
Orville Wright, Dayton, Ohio.
H. E. Talbot, Jr., Dayton, Ohio. Dayton Wright Co.
Perry Austin Co., Grasmere, Staten Island.

AIR PHOTOS TO AID CITY DEVELOPMENT

Arcadia, Cal.—New fields in engineering studies are being opened at the army balloon and airship school at Ross Field here, in the department of plotting from photographic maps, according to officers of the recently reorganized school. The plotting study room is equipped with an enormous photographic map embracing 250 square miles of territory, almost to Los Angeles, of which Arcadia is the center. The map is a mosaic of several thousand photographs, taken by balloon or airship from an altitude of 500 feet.

As a result of these studies by the Langley Field, Va., and Arcadia school, the two great airship schools of the Army Air Service, a number of cities are planning to use aerial photographic maps in connection with city planning, traffic control, street widening and fire protection work, according to army officers.

Other uses to which photographic maps are being put are preliminary investigations of watersheds, hydroelectric developments, highway, railroad and canal location, forest surveys and various engineering works.

Army air officers have perfected automatic timing of exposures to cover the proper ground area and at the same time secure the necessary overlap for the accurate fitting together of individual negatives. This permits taking of pictures from the moving airship or aeroplane. Lenses have been discovered especially adapted for this type of work, and the officers have developed the technique covering such details as the best height from which to take pictures for specific purposes, speed of aeroplane and maintenance of level flight to insure verticality of view. The maps now produced by air service photographers, according to officers, attain a high degree of accuracy and wealth of valuable detail.

Aerial photography is among the subjects taught at the Ross Field school. Air Service officers point out that among points of particular value to engineering to be found in aerial photography are the speed with which such maps may be produced, ability to cover territory inaccessible on foot, comparatively low cost and impossibility of omitting any feature of the area photographed.

The mosaic map, army officers say, does not mean transit, stadia and plane-table are in the discard, but that engineering surveys made solely by these time-tried instruments will be out of date.

THE CHOICE OF WING SECTIONS FOR AEROPLANES

EDWARD P. WARNER

Secretary, Committee on Aerodynamics National Advisory Committee for Aeronautics.

(Technical Note National Advisory Committee for Aeronautics)

EVER since the use of wind tunnels first began to give some sort of quantitative data on the comparative performance of aerofoil sections, there has been warm dispute as to the best methods of treating the data thus obtained, and as to the most useful criteria for judging the relative merits of various sections. Although scores of such criteria for comparison have been devised and have been advocated with enthusiasm by their inventors, none of them have gained universal acceptance, and indeed, it is evident that there can be no single formula for judging the aerodynamic merits of wing sections, even if structural considerations be left out of reckoning entirely. The factors entering are far too numerous, the conditions under which the wings have to work on different types of aeroplane are too diverse to permit of the deduction of any single formula which will automatically point the way to the best section in all cases.

The subject of choice of section is by no means a closed one, and despite the impossibility of making a single rule serve, it is quite practicable to deduce in a strictly rational manner a series of rules and formulas which are capable of being of the greatest use if we but confine ourselves to the consideration of one element of performance at a time.

There are seven such elements of performance which may be taken up in turn, the seven being of different relative importance in different types of aeroplanes. They are:

(a) Maximum speed, regardless of minimum
(b) Maximum speed for given minimum
(c) Maximum speed range ratio
(d) Maximum rate of climb
(e) Maximum absolute ceiling
(f) Maximum distance non-stop
(g) Maximum duration non-stop.

Each of these in turn will be treated separately. (a) and (b) obviously cannot both apply to the same airplane, (a) really being applicable only to racing aeroplanes which are always to be landed on good fields and where the landing speed can accordingly be increased to abnormally high figures.

A. Choice of Wing Section for Maximum Speed, Regardless of Minimum.

If the design is to be made with maximum speed as the sole desideratum, obviously the sole requirement is that the drag shall be as small as possible, and since the loading and area can be adjusted so that the aeroplane will fly at maximum L/D at maximum speed this is equivalent to choosing for maximum L/D alone. Flying at maximum speed at maximum L/D, however, entails landing at about 70% of the maximum speed.

In the more common case where a minimum area is initially fixed and the best wing section is to be chosen for that area and a given weight, it is necessary to take account of the power and weight in order to determine the angle of attack at which the aeroplane flies at maximum speed. At maximum speed

$$C_L V^2 = \frac{W}{S\frac{\rho}{2}} \text{ and } (C_D S + C_R)\frac{\rho}{2} V^3 = 550\,\pi$$

where C_R is the coefficient of parasite resistance for the whole aeroplane, P the engine horsepower, and π the propeller efficiency. V is the speed in feet per second and S is given in square feet. If we assume that the parasite resistance is one-half of the total resistance at maximum speed and that the propeller efficiency is 80%, the second equation becomes:

$$2\,C_D\frac{\rho}{2} S\,V^3 = 440\,P$$

$$C_D V^3 = \frac{440\,P}{\rho\,S} = \frac{186{,}000\,P}{S}$$

From the equation of lift

$$V = \sqrt{\frac{W}{C_L\frac{\rho}{2} S}}$$

Combining the last two equations, at maximum speed

$$C_D\left(\frac{W}{C_L\frac{\rho}{2} S}\right)^{3/2} = \frac{440\,P}{\rho\,S}$$

$$\frac{C_D^2}{C_L^3} = \frac{(440)^2\,\rho\,P^2\,S}{8\,W^3} = \frac{57.5\,P^2\,S}{W^3}$$

a relation which makes it possible to determine approximately the conditions under which a wing will work at maximum speed of a given aeroplane without the necessity of making detailed performance calculations in advance.

The object is to secure as high a wing efficiency as possible at the maximum speed of flight, or, since resistance is equal to weight divided by L/D, to secure a maximum L/D at a prescribed value of $\frac{C_D^2}{C_L^3}$. The choice of a wing for maximum speed with a given area can therefore be made by plotting L/D against $\frac{C_D^2}{C_L^3}$ for several aerofoils. The best wing section is that which has the largest ordinate at an abscissa equal to $\frac{57.5\,P^2\,S}{W^3}$, for conventional types. On cantilever-wing designs and others where it is evident that the parasite resistance is less (or more) than one-half the total the constant may be modified accordingly. In cantilever racing monoplanes, for example, 85 may be used instead of 57.5. In comparing sections for a given design, however, the same constant should always be used throughout.

In order to illustrate the use of this method, curves of L/D against $\frac{C_D^2}{C_L^3}$ for a number of sections are plotted in Fig. 1. Taking, for example, the case of a 300 HP pursuit aeroplane weighing 2,500 lbs. and having 240 square feet of wing surface, $\frac{57.5\,P^2\,S}{W^3} = .0795$. Erecting a vertical on Fig. 1 at this abscissa, it is clear that the best results are given by the U. S. A. 16, 17, and 21, and the R. A. F. 15.

B. Choice of Wing Section for Maximum Speed with a Given Minimum.

This case may also be treated in two different ways, depending on whether or not allowance is made for change of weight with changing area. We shall first assume the weight to be fixed independently of wing section and area.

In this case, the wing loading is at once given by the equation:

$$W = C_{L\max.}\frac{\rho}{2} S\,V^2_{\min.}$$

At maximum speed, just as in case (A):

$$\frac{C_D^2}{C_L^3} = \frac{57.5\,P^2\,S}{W^3}$$

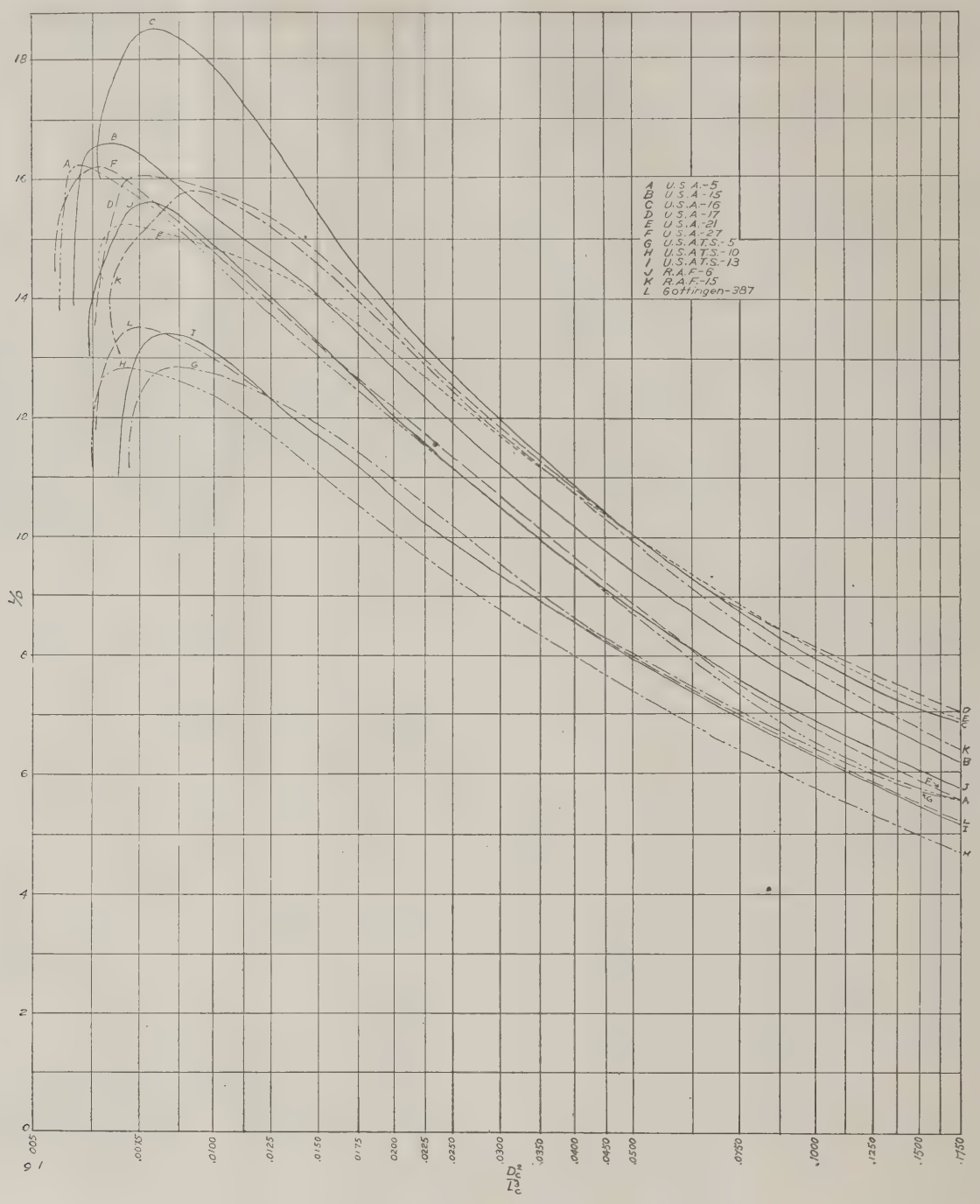
but S is now a variable and can be eliminated by using the equation of landing speed.

$$\frac{W}{S} = C_{L\max.}\,V^2_{\min.}$$

$$\frac{C_D^2}{C_L^3} = \frac{57.5\,P^2}{C_{L\max.}\,V^2_{\min.}\,W^2\times\frac{\rho}{2}} = \frac{48400}{C_{L\max.}\,V^2_{\min.}\,W^3\,\frac{\rho}{2}}$$

Taking the square root of each side.

$$\frac{\frac{C_L}{C_D}}{\sqrt{\frac{C_{L\max.}}{C_L}}} = \frac{\frac{W}{P}\times V_{\min.}}{220}$$



The wing giving the lowest resistance at maximum speed under these conditions can therefore be found by plotting L/D against $\frac{L/D}{\sqrt{\frac{C_{L\,max.}}{C_L}}}$ and noting the ordinates at the point where the abscissa is 1/150 of the power loading times the minimum speed, or, alternatively, by plotting against $\frac{C_D^2}{C_L^3}$ and comparing the L/D ratios at the points where the abscissa is equal to $\frac{48{,}400\ P^2}{C_{L\,max.}\ V^2_{min.}\ W^2}$, this abscissa being different for different wing sections.

As an illustration of this method, the same problem may be used as was employed in case (A), specifying a minimum speed of 50 m. p. h. in place of an area of 240 square feet.

Tabulating the results for the several wings:

Name		$C_{L\,max.}$	$\frac{48{,}400\ P^2}{C_{L\,max.}\ V^2_{min.}\ W^2}$	L/D
U. S. A.	5	1.290	.1005	6.59
	15	1.184	.1093	7.28
	16	.992	.1304	7.38
	17	1.082	.1199	7.81
	21	.913	.1419	7.34
	27	1.411	.0918	7.03
U. S. A. T. S.	5	1.512	.0858	6.81
	10	1.732	.0747	6.46
	13	1.294	.1003	6.34
R. A. F.	6	1.200	.1080	6.78
	15	1.109	.1161	7.40
Göttingen	387	1.640	.0792	6.93

The comparisons so far, based on the assumption that the wing drag is a fixed proportion of the total, indicate that the ratio of effective parasite resistance surface (equivalent flat plate area) to wing area is larger in the case of a thick wing with a large drag coefficient than in the case of a thin wing. This conclusion is correct in respect to the fuselage, the resistance of which decreases proportionately less rapidly than does

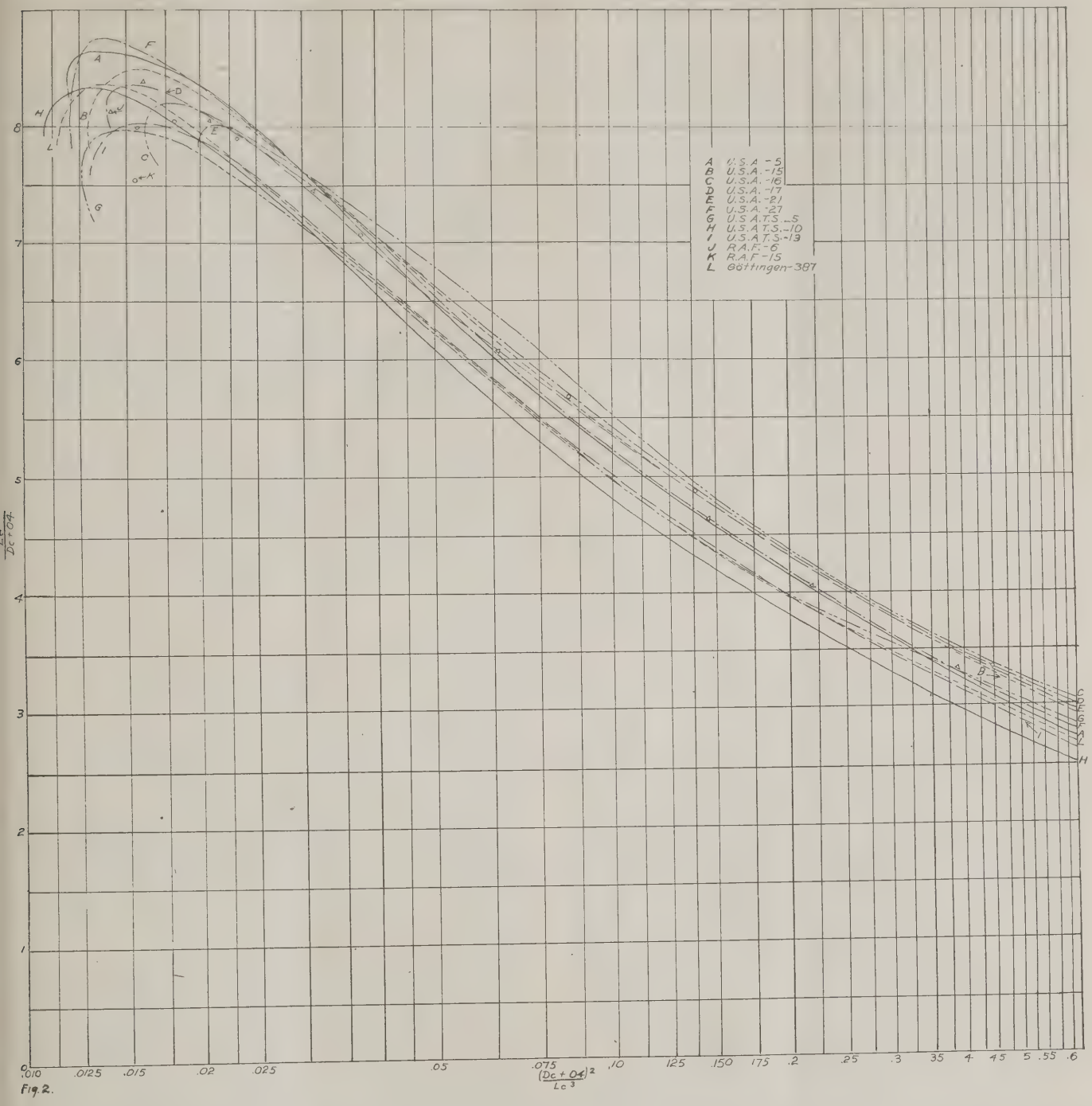


Fig. 2.

the wing area when the latter is changed. The resistance of the interplane bracing, however, is generally a much smaller fraction of the wing drag for thick wings with high drag coefficients than for thin sections. The method employed is, on the whole, unfair to the thick sections. A possible alternative is to use $\frac{C_L}{C_D + .04}$ instead of L/D, as a criterion of efficiency, assuming that the parasite resistance for the whole aeroplane is $.04 \frac{\rho}{2} S V^2$ in all cases, A being the wing area. It can readily be shown that, on this assumption, $\frac{(C_D + .04)^2}{C_L^3} = \frac{230 P^2 S}{W^3}$, $\frac{C_L}{C_D + .04}$ must therefore be plotted against $\frac{(C_D + .04)^2}{C_L^3}$. This has been done for 12 sections in Fig. 2. In order to avoid confusion among the large number of curves, the R. A. F. 6 and 15 have been indicated by points only. On the whole, this method of comparison is fairer than that previously described, especially where sections of widely varying thickness are to be compared. It will be noted, however, that the conclusions drawn from Figs. 1 and 2 are not very different, the relative rank of the sections being much the same except that the thick sections show up better by the method of Fig. 2.

As a specific example, the problem just solved by the first method will be treated by using Fig. 2. The numerical value of the abscissa for each section must then be just four times as high as in the first case, and the corresponding efficiencies are as tabulated below.

Section		$\frac{C_L}{C_D + .04}$
U. S. A.	5	3.25
	15	3.33
	16	3.23
	17	3.29
	21	3.09
	27	3.39
U. S. A. T. S.	5	3.46
	10	3.32
	13	3.16
R. A. F.	6	3.23
	15	3.33
Göttingen	387	3.45

The six best sections by the two methods, arranged in order of merit, are:

Rank	By Fig. 1	By Fig. 2
1	U. S. A. 17	U. S. A. T. S. 5
2	R. A. F. 15	Göttingen 387
3	U. S. A. 16	U. S. A. 27
4	U. S. A. 15	R. A. F. 15
5	U. S. A. 21	U. S. A. 15
6	U. S. A. 27	U. S. A. T. S. 10

Turning now to the derivation of a formula to take account of the change in weight with varying area, it can be shown that the total weight of an aeroplane is approximately proportional to $S^{1/6}$, other things being equal, where A is the wing area.

The equation of maximum speed then becomes:

$$\frac{C_D^2}{C_L^3} = \frac{57.5\ P^2\ S}{(K\ S^{1/6})^3} = \frac{57.5\ P^2\ \sqrt{S}}{K^3}$$

If W_o and S_o represent the initial weight and the corresponding area for some particular wing section,

$$W_o = K\ S_o^{1/6}$$

$$K^3 = \frac{W_o^3}{\sqrt{S_o}} = W_o^{5/2}\ V_{min.} \sqrt{\frac{C_{L\,max.}\ \rho}{2}}$$

Since the $C_{L\,max.}$ in this last equation relates to a particular wing section, that for which W_o and S_o are taken, it must be a constant. Taking 1.3 as an average value of $C_{L\,max.}$ and substituting, and then combining the last two equations,

$$K^3 = .039\ W_o^{5/2}\ V_{min.}$$

$$\frac{C_D^2}{C_L^3} = \frac{57.5\ P^2 \sqrt{\frac{2\,W}{C_{L\,max.}\ \rho}}}{.039\ V^2_{min.}\ W_o^{5/2}} = \frac{42{,}800\ P^2 \sqrt{\frac{W}{C_{L\,max.}}}}{V^2_{min.}\ W_o^{5/2}}$$

Neglecting the small difference between $\sqrt{W}$ and $\sqrt{W_o}$ in any particular case, this becomes:

$$\frac{C_D^2}{C_L^3} = \frac{42{,}800\ P^2}{\sqrt{C_{L\,max.}}\ V^2_{min.}\ W_o^2}$$

In this case, since the weight is not a constant, it does not suffice to compare values of L/D.

Resistance at maximum speed

$$\frac{W}{L/D} = \frac{K\ S^{1/6}}{L/D} = \frac{K\ W^{1/6}}{L/D \times V^{1/3}_{min.}\ C_L^{1/6}{}_{max.} \left(\frac{\rho}{2}\right)^{6/1}}$$

Neglecting the small changes which would occur in $W^{1/6}$, it becomes apparent that the minimum total resistance for a given weight power and minimum speed is given by the wing which has the largest value of $L/D \times \sqrt[6]{C_{L\,max.}}$ at the point where

$$\frac{C_D^2}{C_L^3} = \frac{42{,}800\ P^2}{\sqrt{C_{L\,max.}}\ V^2_{min.}\ W^2_o}$$

Since $C_{L\,max.}$ has a single definite value for each section, this comparison, like the preceding one, can be made by plotting L/D against $\frac{C_D^2}{C_L^3}$, the ordinate being read off at the appropriate abscissa for each wing section and each ordinate so determined being multiplied by $\sqrt[6]{C_{L\,max.}}$.

(To be continued)

DAYTON WRIGHT MODEL FP-2 SEAPLANE

THE Dayton Wright Company early appreciated the fact that one of the most practical and profitable uses of the aeroplane lay in its many advantages as a means of making accurate photographs and maps quickly, and at a minimum amount of expense. It was at once realized that the topographical features of the great forest districts of Canada were such as to make surveying and mapping by land slow and expensive, and it was also realized that the many bodies of water scattered throughout the country made it ideal terrain over which to operate seaplanes. The Engineering Department of this company thereupon set about the design of a plane specially for this purpose and which would be ideally adapted for aerial photographic work and timber spotting in the Canadian forest district. It was first necessary to study the actual conditions, and, with this end in view, a pilot from this company spent an entire season carrying on work of this nature in Canada. With the practical results obtained from this experience at hand, the Engineering Department developed the Dayton Wright model FP-2.

It was of course necessary to build a water ship, and the float type was selected as more desirable than the boat type, because of its greater ability to maneuver quickly in tight places. In order to minimize the danger of forced landings from motor trouble, the plane has been equipped with two Liberty engines, which give a sufficient normal excess of power, that level flight can be maintained with one engine, should the other, for any reason, become incapacitated. Two motors were also found desirable, inasmuch as a sufficient amount of power was necessary to enable the ship to get off in as short a space as possible. In its test flights, the FP-2 took off in the extraordinarily quick time of twenty-two seconds.

In order to successfully carry out observation work and photography, the occupants must have unrestricted vision to the front, to the sides and below. This has been amply accomplished in the FP-2 by placing them well forward in the nose of the fuselage, and providing ample window space. Another matter of prime importance in successful photography is steadiness of flight, and the designers have been so successful in obtaining this that the plane will maintain its course



The Dayton Wright Model FP-2 Seaplane

with the pilot's hands off the controls. The camera is universally mounted, so that any angle which the plane may take, the camera is always vertical.

Provision has been made so that the crew can be self-sustaining on exploration trips into isolated territories. The cabin is large enough for bunks to be installed in the rear, and sufficient provisions and equipment carried for trips of many days' duration.

We feel that this plane will fill the long felt want, and that many miles of territory will be mapped, and much valuable information will be obtained by its use after the flying season opens next Spring in Canada.

While the Canadian work has been stressed, the FP-2 is of course an ideal photographic ship and will find its market wherever mapping and photographing are required near bodies of water.

Dimensions & Specifications—FP-2

Model: Dayton Wright FP-2.

Type: Twin motor, twin float, biplane.

Use for which designed: Aerial photography and timber spotting.

Overall dimensions: Length, 36′ 10¼″; height, 14′ 0″; width, 51′ 5″.

Carrying capacity: Crew, four; equipment, camera and films, map table, folding canoe, fire extinguisher, axe, etc.

Power plant: Engines, 2 Liberty "12" 421 H. P. each; propellers, 2 tractor, 4 bladed, 8′ 9″ diameter; gasoline, gravity feed, 140 gallons.

Wing data: Chord, (both wings) 84″; span, (both wings) 51′ 5″; incidence, (both) to propeller axis, 2°; gap, 92-½″; stagger, none; sweepback, none; dihedral, 2°; wing section, U. S. A.-27.

Area: Wings, (total, including ailerons) 668 sq. ft.; ailerons, (total, four) 88 sq. ft.; stabilizer, 53.8 sq. ft.; elevators, 29.0 sq. ft.; vertical fins, (three) 20.8 sq. ft.; rudders, (three) 28.7 sq ft.

Weights: Empty aeroplane, 5,726 lbs.; gasoline and oil, 916 lbs.; total useful load, 1,862 lbs.; total gross load, 7,588 lbs.; power loading, 9.02 lbs. per h.p.; wing loading, 11.35 lbs. per sq. ft.

Performance: High speed at sea level, 120 m.p.h.; landing speed, 63 m.p.h.; climb to 5,000 ft., 9 minutes; service ceiling, 18,000 feet; flight range, (at high speed) 250 miles; flight range, (at ecn. speed) 325 miles; time to take off from water, 22 seconds.

A MECHANICAL DEVICE FOR ILLUSTRATING AEROPLANE STABILITY

By F. H. NORTON

(Technical Note National Advisory Committee for Aeronautics)

Summary

AN instrument is described which will illustrate completely in a qualitative sense the longitudinal stability characteristics of an aeroplane. The instrument is primarily of use for the lecture room, but it is hoped that ultimately it will be possible to obtain quantitative results from it.

Introduction

It is a very simple matter to construct a piece of apparatus which will show dynamic stability or damped oscillations—for example, a pendulum. A simple device which can be altered to give any degree of stable or unstable motion has long been desired, and as far as it is known, the instrument described below is the only simple method for accomplishing this.

At first it was expected that only the degree of damping of an oscillation would be illustrated, but as the instrument was more carefully studied it became evident that nearly every property of the flying aeroplane was represented with astonishing exactness. This is confirmed by the fact that the equations of motion work out in almost identical form with those of Bryan and Bairstow for the aeroplane.

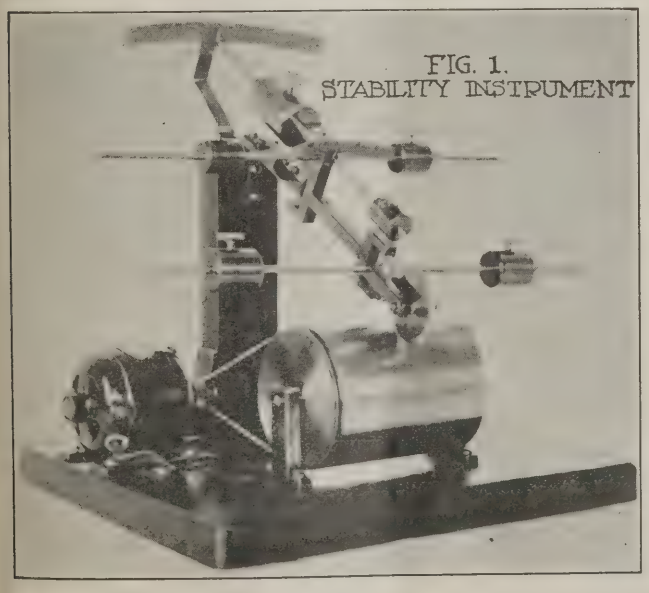


FIG. 1.
STABILITY INSTRUMENT

A description of this instrument is given here because: first, it should be of interest to lecturers on aeronautics; second, it will allow mathematicians to visualize the actual behavior of an aeroplane without having to make flights; and third, it holds the possibility of mechanically solving the stability equations.

Description of Instrument

A complete view of the instrument is shown in Fig. 1. It consists essentially of a double pendulum, the lower end of which is a wheel resting on a revolving drum as shown diagramatically in Fig. 2. The drum can be turned at any speed by an electric motor, and the stability and moment of inertia about the two pendulum axes can be varied at will. The properties of the aeroplane are represented in the following way:

1. The restoring moment about axis (A) is the pitching moment about the C. G. of the aeroplane and represents static stability or metacentric height.

2. The restoring moment about axis (B) is the damping of the aeroplane—M_q.

3. The moment of inertia about (A) represents the mass of the aeroplane.

4. The moment of inertia about (B) represents the moment of inertia of the aeroplane about the Y-axis.

5. The angular motion about (A) represents changes in air speed along the path — V.

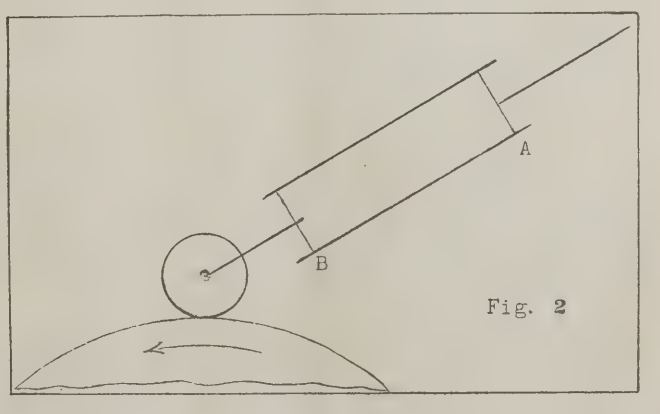


Fig. 2

6. The motion about (B) represents changes in inclination of the machine in respect to the horizon.

7. The angular movement of the wheel in relation to the drum axis represents the inclination of the path with the horizon.

Just why the above representation is true can not be explained at present, but from actual trial the instrument does behave in this manner. The speed of rotation of the drum has some influence on the characteristics of the motion, but just what this effect is has not yet been determined.

By adjusting the upper balance weight, any degree of static stability may be obtained and the change from an oscillation to a divergence is clearly illustrated. The oscillation is more stable (greater damping) when either the mass of the aeroplane (upper lateral weights) is increased or the moment of inertia (lower lateral weights) is decreased as indicated by theory.* The damping is also varied by changing the moment about the lower axis.

An oscillation can be produced which is stable below a certain magnitude and unstable above it. It is also possible to produce an oscillation which will damp down to a finite value and remain there permanently. This is particularly interesting as the same phenomenon has been observed in actual flight.

This particular design of instrument has the disadvantage that the moment of inertia about each axis is changed at the same time as the restoring moment so that the two effects are combined. This can easily be remedied by the use of springs instead of weights, and will be so changed in another instrument.

* Thomson, "Applied Aerodynamics", p. 208.

Theory of the Instrument

Instrumental records taken in flight of the air speed and path angle during an oscillation of constant amplitude show that these variables are, as closely as can be determined, sine functions of the time, but are of course at a small phase difference. The path of the aeroplane in space can not be a sine curve, but in stability calculations the amplitude has been assumed so small that the departure from it is negligible. By assuming small oscillations, angles may be used in place of sines of angles and the usual theory of Bryan and Bairstow can be applied. Working in the same way, W. P. Angel has carried out an analysis of this instrument which gives equations of the same form as for the aeroplane. In both cases however the oscillations are assumed small and so can not apply strictly to the actual conditions. It is felt that if an exact solution can be made of the motion of this instrument, we shall have at the same time the exact solution of the aeroplane motion. It is hoped that mathematicians will interest themselves in this problem.

Uses

This instrument is useful for making visible the very complex behavior of the aeroplane during an oscillation. In several instances new facts were observed on the instrument and later checked in flight. It can also be used for illustrating in the classroom or lecture hall the effect on stability of making changes in the various characteristics of the aeroplane.

It is hoped that this instrument may be used quantitatively to determine the type of oscillation for a new aeroplane, by settling the characteristics (mass, moment of inertia, damping, etc.) of this aeroplane on the graduated scales of the instrument. Whether this can be done or not is difficult to predict but experiments along this line will be carried out.

COST FIGURES ON OPERATING AEROMARINE FLYING BOAT PASSENGER AND MAIL SERVICE

Extracts from Address of C. F. Redden, President Aeromarine Airways, Inc., Before Metropolitan Section, Society of Automotive Engineers

JUST as the automobile opened up the rural districts and made it possible for a business man to live twenty miles from his office and motor into town, so will the aircraft ultimately extend that zone of population from twenty miles to one hundred miles, and homes will be built on the shores of lakes and rivers and in inaccessible mountainous districts that are now practically worthless except for camp sites.

Eighteen months ago we inaugurated a passenger-carrying service around New York, up and down the Sound and from New York to Atlantic City. After five months' operation we felt justified in enlarging our operating organization, and on November 1st of last year a fleet of six 11-passenger converted Navy boats inaugurated a daily mail and passenger service between Key West and Havana, flying across one hundred miles of open seas, also between Palm Beach, Miami, Bimini and Nassau. Although the Havana harbor is probably one of the most difficult points on the map from which to operate, and notwithstanding the fact that neither Key West nor Havana affords any particular commercial advantage, when compared with industrial centers such as New York and Chicago, or Detroit and Cleveland, the service is officially recognized as a desirable means of travel.

This service has proven beyond any question of a doubt that a commercial line between such points as Cleveland, Detroit or other cities similarly located would prove not only profitable but would meet a great public need. During the past year our fleet of fifteen boats has flown nearly 100,000 miles. They have carried 6,814 passengers and 29,002 pounds of freight and mail, and without a single serious mishap.

This distance from Key West to Havana is approximately one hundred miles, yet we make the flight in one hour and fifteen minutes—the time by seamboat is approximately ten hours, and, due to the roughness of the Gulf Stream, it is not always a pleasant passage.

Last spring we sent one of our 11-passenger flying boats, the Santa Maria, on a trip from Key West to New York, to Montreal, down the St. Lawrence to Toronto, to Buffalo, Detroit, Mackinaw and Chicago, thence down the Mississippi River to New Orleans, and then back to her base at Key West. This was the longest commercial aeroplane flight ever taken. We made a stop at practically every city and town of any importance en route. We would come down in a more or less unknown and uncharted harbor where no provision whatever had been made for our direction or convenience—we would take on fuel, take a few passengers for sightseeing hops, and then "take off" to come down again in some other strange harbor. This flight covered a little over 7,000 miles, at an average speed of seventy-five miles per hour, with no special roundhouses, bases or service stations en route. If you tried to equal this record of speed and endurance with a modern locomotive traveling on smooth rails and with every device for its protection and safety and a roundhouse every two hundred miles, you would probably have nothing but a heap of junk at the end of the trip.

Another converted Navy boat with a single Liberty motor was sent on a passenger-carrying trip from New York to Chicago and return, carried hundreds of passengers at different cities en route, and without a single mishap.

It seems to me that performances of this kind prove that safe flying has arrived.

The Santa Maria on its arrival at Key West was given an overhauling and will soon be in daily service again between Key West and Havana.

We are frequently asked why we use flying boats exclusively instead of land planes. The answer is:

First. There is a large percentage of the public who would not go up in a land plane, but who will take a flight in a flying boat because they feel that a safe landing place is always available. The result is, the cost of procuring passengers is not so great as with the land planes.

Second. Many of these people would not think of traveling at the high altitude considered safe for flying over land, whereas flying ten or fifteen or one hundred feet above the water does not seem to worry them.

Third. With flying boats we eliminate the necessity of expensive landing fields, often located at remote parts of the city. Our landing fields are Uncle Sam's rivers, harbors and lakes, and as the business center of every port is near the water front, our anchorage is always convenient to the hotels and to the center of business activity.

Fourth. For the above reasons we believe that for some time to come flying boat operations will afford greater returns for the money and effort expended than in operating land machines.

The operating costs which I am about to give you are based on the operation of the converted Navy boat equipped with both single and double Liberty motors, and while there are no doubt other types of aircraft which show a lower fuel cost per passenger mile, that saving is insignificant when contrasted with the low initial cost and the *safety* of these Navy boats for passenger-carrying purposes.

(*Continued on page 427*)

NAVAL and MILITARY AERONAUTICS

Reorganization of the Office of the Chief of Air Service

Under the reorganization of the Office of the Chief of Air Service, approved by General Patrick on December 1, 1921, five divisions are provided, viz.: Personnel, Information, Training and War Plans, Supply and Engineering. The office of the Chief includes the Assistant Chief of Air Service and the Executive Office. Subordinate to the Executive Office are the Finance and Medical Sections, the Legal Advisor and the Director of Aircraft Production (Spruce Production Corporation). The Orders and Files Section is under the immediate supervision of the Chief Clerk.

The Personnel Division is composed of three sections—Officers, Enlisted and Civilian. The Information Division comprises the Library Section, Special Section and Reproduction Section. Five Sections comprise the Training and War Plans Division, viz.: Schools Section, Tactical Units Section, R. O. T. C., National Guard and Officers' Reserve Section, War Plans Section and Airways Section. The Supply Division embraces the Property-Requirements Section, the Procurement Section and the Material Disposal and Salvage Section. The Engineering Division, located at McCook Field, Dayton, Ohio, a technical representative of which is on duty in Washington, is composed of the Planning Section, Technical Section, Factory Section, Flying Section, Procurement Section, Supply Section, Patents Section and Military Section.

The following assignment of officers on duty in the office of the Chief of Air Service has been made:

Executive, Major Walter H. Frank; Assistant Executive, Major Hubert R. Harmon; Chief of Personnel Division, Major Rush B. Lincoln; Chief of Information Division, Major Horace M. Hickam; Chief of Training and War Plans Division, Lt.-Col. James E. Fechet; Chief of Supply Division, Lt.-Col. William E. Gillmore; Chief of Engineering Division, Major Thurman H. Bane; Chief of Finance Section and Budget Officer, Air Service, in Office of Executive, Major Jenner Y. Chisum; Chief of Medical Section in office of Executive, Colonel Albert E. Truby.

To duty in:

Personnel Division: Major J. W. Simons, Jr., 1st Lieut. George E. Hodge.

Information Division: Capt. David S. Seaton, 1st Lieut. Charles H. Mills.

Training and War Plans Division: Major Herbert A. Dargue, Major Walter G. Kilner, Major Percy E. Van Nostrand, Major Leo A. Walton, Major Oscar Westover, Major Barton K. Yount, Capt. Oliver S. Ferson, Capt. Burdette S. Wright, 1st Lieut. Robert J. Brown, Jr., 1st Lieut. Wm. E. Connolly and 1st Lieut. Horace S. Kenyon.

Supply Division: Lt. Col. Harry Graham, Major Roy M. Jones, Major George E. A. Reinburg, Major Walter R. Weaver, Capt. Frederick F. Christine, Capt. Aubrey I. Eagle, 1st Lieuts. Wm. V. Andrews, Charles G. Brenneman, Edwin F. Carey, Aaron E. Jones, Benjamin R. Morton, and Edwin R. Page.

As Engineering Representatives: Major Henry W. Harms and 1st Lieut. Ernest E. Harmon.

Office, Assistant Chief of Air Service: 1st Lieut. Clayton L. Bissell.

Finance Section: Captain William F. Volandt.

Medical Section: Major Benjamin B. Warriner and Captain William J. Freebourn.

General Bandholtz Inspects Bolling Field

On December 7th Brigadier General Bandholtz, Commanding General of the newly formed District of Washington, inspected Bolling Field and its personnel. His expressed desire of having the soldiers at this station, in their appearance and drill, compare with the standard maintained at other Army stations in this District, is being rapidly fulfilled. New Melton cloth, well-fitting uniforms, are to be issued to all soldiers, and they are filled with the determination to show that the Air Service cannot be outdone in any military duty required of it.

This inspection was followed on December 10th by another by Major General Patrick, Chief of Air Service, whose talk afterwards was an encouragement and inspiration for better things in the future.

National Guard Aero Squadron Organized

The 137th Observation Squadron, Air Service, Indiana National Guard, was granted Federal recognition on August 1, 1921, and has to date received most of its equipment. Two large steel Government hangars, size 66 x 120, have been received. Ships are being set up at Wilbur Wright Field at the present time and will be flown to Kokomo, Indiana, the location of this squadron, very shortly. The minimum strength of the squadron is 24 officers and 90 enlisted men, and the maximum strength 132 enlisted men and 31 officers.

Navy Abandons Plans for Joint Manoeuvres

Washington.—The annual joint manoeuvres of the Atlantic and Pacific fleets, which were to be held in Panama Bay in February and March, 1922, have been abandoned, the Navy Department announced. The decision was reached by the department, it was stated, in the interests of economy and because of the shortage of funds available for purchase of required fuel.

Independent drills will be held by a number of warships of the Atlantic fleet, beginning January 3, in Guantanamo Bay, and drills and target practice will be conducted off the California coast by the Pacific fleet, the Navy Department announced.

A Loss to Naval Aviation

Naval Air Current, the service publication published at San Diego, Cal., announces in its issue of December 15 that, in compliance with an order from the Bureau of Navigation, it ceases publication with this issue.

This is to be greatly regretted, because it has been one of the best edited service publications, and has wielded a substantial influence for the good of naval aeronautics.

New Navy Laboratory

Work is progressing satisfactorily on the construction of the naval experimental and research laboratory at Bellvue, near Washington. The laboratory buildings are substantially completed and ready to receive their equipment. The present appropriations will provide for the cost of equipping and fitting the buildings, and will not cover the expenses of maintenance of the establishment in commission, consequently it will be necessary for the department to ask for subsequent appropriations before the laboratory is commissioned as a naval station. Captain E. L. Bennett, who has been selected as the director of the laboratory, has been detached from command of the U. S. S. New York and will report at the department about January 1 as the relief of Rear Admiral Wm. Strother Smith, U. S. N., who has developed the laboratory from its inception. Rear Admiral Smith has already reached the age of retirement and will be detached when Captain Bennett reports.

Airship Training at Ross Field

The course in Primary Airship Training for the class of officers stationed at Ross Field was started Monday, November 14, 1921, and the class is now deep in the intricacies of Navigation and Aerostatics. The work is proving very interesting and it is planned to make this department one of the strongest at the field. A motor room, where the actual tearing down and building up of aerial motors can be undertaken, is now being built and, in many other ways, the course in airship training will be made as interesting and instructive as possible. Very satisfactory progress has been made on the construction of two new steel hangars at this field. The grading and foundation work has been practically completed, and with the arrival of the steel the work will be pushed to rapid completion. Two airships, Types "C" and "D", are being shipped to Ross Field, and the arrival of these ships is eagerly awaited by the personnel, everyone being extremely anxious for an opportunity to ride in them.

Free Balloon Flight

A free ballon left McCook Field about 9:40 a. m., November 29th, and soared off to the northeastward before a brisk wind. The flight was made principally for the purpose of testing out a number of new instruments just received, and which includes a new statiscope, a barograph and a verimeter. Those who took the trip are Major Napier, Captain McFarland, Lieut. Schneeberger, Art Smith and W. E. Huffman.

FOREIGN NEWS

Aviation Lines in Brazil

A committee of the Brazilian Senate has reported favorably, according to the United States Naval Attache in Rio Janeiro, upon a bill proposing the establishment of two aviation lines between Rio de Janeiro and Porto Alegre, which are to be started before September, 1922. One of the routes will be laid out along the coast, carried out by hydroplanes, and maintained and directed by the Ministry of Marine; the other will traverse the interior of the country to the west of the coast range of mountains, and will be carried out by aeroplanes under the direction of the Ministry of War. The routes will pass through the most important political, industrial, and commercial centers wherever possible.

Aviation Rights in Chile

The Government of Chile has under consideration a 15-year exclusive concession for commercial aviation rights. Information has been received by the Department of Commerce from Rollo S. Smith, secretary in the office of the Commercial Attache at Santiago, to the effect that a petition from the local representative of the Spad and Bleriot aeroplane factories has been submitted to the Chilean Government, seeking a 20-year exclusive franchise to install and operate an aerial service between Iquique, Concepcion, and intermediate cities. The tariffs to be put in force, if the franchise is granted, will be submitted to the Government for its approval, and the landing stations will be at the disposition of military aviators. An advantatge claimed for the proposed service is that the trip from Santiago, the capital, to Antofagasta—a distance of 1,552 kilometers by rail and requiring a two days' journey—could be accomplished by aeroplane in something over five hours and at a cost per passenger of 500 pesos for the round trip.

Amsterdam Service Suspends

The aerial service between London and Amsterdam will be temporarily suspended for the winter months, according to the London *Times*. This service, which is run by a Dutch company known by the initials of K. L. M., and using Fokker machines, began operations in April. Since then the company's aircraft have made 352 flights between London and Amsterdam. In April next year the company intends to reopen the route with one service each way daily, which will be increased to two services a day on May 1st. The subsidy of Fl. 200,000 (about £17,500) granted to the K. L. M. by the Dutch Government for the years 1920 and 1921, which was intended to meet two-thirds of the company's estimated losses, has proved to be insufficient, and an increase of subsidy, amounting to Fl. 260,000 (about £22,800) has been applied for. The total estimate for civil aviation included in the Dutch Budget of 1922 amounts to Fl. 1,315,000 (about £115,000), of which Fl. 370,000 is asked to cover two-thirds of the company's estimated losses in the coming year. During five months this year the K. L. M. service carried 410 passengers between London and Amsterdam and, besides mails, nearly 18,000 tons of goods, nearly all British exports.

New English Company

According to the London *Financial Times*, an aviation company is to be formed to establish a route between Ostend, Brussels and London, having secured a substantial government subsidy for this purpose. The organization is practically complete, and includes as manager a man who is the prime mover in aerial navigation and has organized practically all the previously existing air services in England. It is intended to maintain a special daily service between Ostend and London throughout next summer.

Berlin Journal Asserts France Plans Air Attack on Germany

France is concentrating air forces in Alsace-Lorraine to secure domination of aerial navigation above the Continent, according to a Dutch officer writing anonymously in the *Lokal-Anzeiger*.

The writer contends that Southern Germany is already under control of the French from the air, as day and night bombing squads are being developed. The *Anzeiger*, a powerful Nationalist organ, tries to prove that France is preparing to attack Germany, but it gives the actual number of French planes in commission as 1,500, which is less than Premier Briand recently stated.

The officer's article says an air division with headquarters at Metz is preparing only for an attack against Germany. There is, he adds, a flying assault squadron at Thionville and Strasburg, supported by day and night bombing brigades, with their base at Nancy and the surrounding regions.

As France is now foremost in developing war planes and is taking advantage more than any other nation of progress in aviation, the writer holds this flying base places France in a position to control the air beyond her frontiers.

M. Michelin Retires

Owing to the state of his health, M. Michelin has felt compelled to resign the Presidentship of the Aero Club of France. M. Michelin has been a valuable asset to aviation from the earliest days, and his resignation must prove a severe loss to the French Club.

Germany and War 'Planes

From Berlin the figures given for aircraft destroyed, etc., up to October 1 last are 127,471 aeroplanes and 20,364 aero engines destroyed and 629 aeroplanes and 3,632 aero engines surrendered.

Gordon-Bennett Balloon Race

It has been decided—until such times as they may alter their views—by the Aero Club of Geneva, that the 1922 Gordon-Bennett Balloon Race is to be held on September 2, and start from Geneva. Zurich in this connection proposes to organize an aviation meeting.

British Air Ministry to Offer £50,000 For a Practical Helicopter Aeroplane

Subject to Treasury sanction, the British Air Ministry proposes to offer a prize of £50,000 for a practical helicopter-designed aeroplane; that is, an aeroplane capable of rising vertically over a given spot.

Following are among the conditions to be observed by the competing designers: The machines must be capable of rising to a height of 2,000 feet under their own power, carrying one man and one hour's fuel supply; able to remain stationary over a ground object for half an hour in any wind up to twenty miles an hour; able to land safely in any wind up to twenty miles an hour without horizontal motion and with the engine cut off; able to maintain a horizontal flight at a height of 2,000 feet at a speed of not less than sixty miles an hour.

Foreign as well as British inventors will be invited to take part in the competition.

Some months ago, it is stated, experiments with the helicopter were to take place at Farnborough with a British inventor's machine. Great secrecy was observed by the Air Ministry in regard to the tests.

According to reports received in London last April, a successful flight with a helicopter had been made abroad. This machine was invented by Lieutenant von Petroczy of the Austrian Army Balloon Corps.

Baby Takes Air Trip

The world's youngest aeroplane passenger is believed to be Christian Martin, the 17 months old son of Louis Martin, a French pilot.

Against the advice of a doctor, Christian was strapped in the seat of an aeroplane beside his father and flew for half an hour over Strasbourg without experiencing any ill effects.

Airmen to Be Guided on Cloud Distances

Among the many important developments being tested here for the proposed scientific illumination for night flying, airmen on the London-Paris route is a method of finding the height of clouds.

The apparatus consists of a powerful searchlight for throwing vertical beams on clouds and an especially designed theodolite, through which to observe the clouds. The searchlight is placed at the measured distance from the theodolite, which consists of a telescope mounted in such a way that the angle at which it is pointed can be read with minute accuracy on a special scale. It is set so that the point where the beam enters a cloud can be seen through the center of the telescope of the theodolite, with the result that it is easy to calculate the height of the cloud from a known angle.

It is proposed to establish this apparatus at stations along the airway so as to inform pilots of cloud distances by wireless.

Air Taxi Flies 2,000 Miles to Deliver Christmas Gift

Alan J. Cobham, well known "air taxi" pilot, has successfully traveled 2,000 miles by air in order to deliver a Christmas parcel in London. He is touring Europe and Northern Africa on a 10,000 mile journey with Lucian Sharpe of Providence, R. I., a wealthy retired American business man. They arrived in Barcelona on December 22, when his "fare" announced he desired to pass Christmas in Madrid, but wanted a parcel delivered in London before Christmas Day.

Cobham left Barcelona Friday morning before Christmas and made a nonstop flight to Dijon. Saturday he flew from Dijon to London without stopping. After delivering the parcel he went to Bristol and passed Christmas Day with friends there. He started his two day return trip to Spain on Tuesday.

Flying a De Haviland "nine," Mr. Cobham is the most successful "air taxi" pilot in the world. He travels "light," without a mechanic. He has flown over practically all the European countries in 1921 and says that in that period he covered more than 20,000 miles. He did not have a single serious accident.

A Modern School Seaplane

The need of a school seaplane really modern in design and construction was felt very much by the Italian and foreign hydroaviation, a seaplane that could answer to all requirements that several land aircraft already had, and to this need the Societa Idrovolanti Alta Italia of Sesto Calende has supplied a new "Savoia" seaplane: the S-23.

The constructors have not only conferred to such aircraft all the experience acquired in the construction of the many types of Savoia machines, but also the old experience gained while running the seaplane training school, instituted by the S. I. A. I. ever since 1915, near by her flying station of S. Anna on Lake Maggiore; this was the first school for pilots of seaplanes founded in Italy, which in a short time began to give a pilot a day, without the least incident, and it will soon be reopened as a training school for civil aviation pilots of seaplanes.

The S-23 is equipped with the economical engine I. F. V4B, the boat is very solidly built with ply wood and one ply birch inside; the duel control is very solid and docile; the equipment of board, handles, etc., have had the most proper and well suited arrangement for pilots' instruction.

Particular care is taken in order to obtain the easiest way of repairs. The machine is generous of stability.

Beside the training of pilots the S-23 can also be employed for services where great speed is not required, for, between the limited power of the engine, the high aerodynamical rendition of the machine, and the economical speed assigned to it (150 Km. p.h.) this very modern Savoia seaplane offers the greatest running economy together with the other good qualities of other Savoia seaplanes.

The following are the characteristics of the S-23: Engine, Isotta Fraschini type V4B, h. p. 160. Best speed about Km. p. h., 150. Landing speed about Km. p. h., 75. Endurance, hours, 2. Weight empty, Kg., 1160. Useful load, Kg., 240. Carring area, square m., 43.39. Maximum wing span, square m., 12.44. Overall length, square m., 10.00. Maximum height, square m., 3.23. Safe factor over, 6.5.



Aerodynamic Tests on an Alsatian Swift

(From a paper read before the L. I. Flight Association)

IN connection with the problems on motorless flight, the aerodynamic properties of our soaring and gliding birds are of especial interest. The following excerpts are from the British Aeronautical Research Committee Test No. 708.

The test was made on an Alsatian Swift. The purpose of the test, primarily, was not to investigate its soaring possibilities, but to compare an efficient bird form with present aircraft forms. However, the results are of especial interest to us, since it tends to disturb one of the most favored of our theories on soaring and gliding.

From time to time, designers come forward with the contention that a radical departure from the stereotyped form of modern aeroplane would be a big advance in aeronautical design. They urge the adoption of an outline similar to that of a bird, referring to birds capable of undertaking extended glides, and contend that these have naturally developed an aerodynamically efficient form which enables them to glide with advantage. The soaring flight of other birds is also instanced as indicating the relatively small expenditure of energy required during flight; and although the mechanism by which this form of locomotion is achieved is still obscure it is claimed that an aeroplane designed to embody the essential features of bird form should prove highly efficient.

The acceptance of this contention is somewhat hindered by the results of the tests following. These show the maximum lift coefficient to be .0026, and the best gliding angle to be 4.55 to 1, corresponding to a maximum lift drift ratio of 4.55. These measurements, of course, refer to the bird with the wings fully distended and maintained in a position which was thought to be suitable for gliding flight; it is possible, therefore, that they represent a low estimate of the performance, which may be exceeded in actual flight owing to the effective alteration of the wing section by muscular means. However, as representative of a particular form of construction, they suggest that no particular advantage is to be gained in practice by use of wings of a similar outline.

Details of the Swift are given in Fig. 1. A noticeable feature of the bird is the large size of body, in comparison with the wing area.

The results obtained at wind velocities of 13.6 and 27.2 m.p.h. are given in the appended table below. It should be noted that the wings were allowed to deform under the wind forces at the lower velocity, but were fixed in relation to the body at the high velocity by means of a fine wire.

Table of Values Obtained at 13.6 m.p.h. and 27 m.p.h. Velocity

Incidence Angle (degrees)	Wind Speed 15.6 m.p.h.			Wind Speed 27.2 m.p.h.		
	Ky	Kx	L/D	Ky	Kx	L/D
0	−.00018	.00023	− .77	.00032	.00027	1.18
2	.00022	.00024	+ .9	.00055	.00027	2.56
4	.00058	.000255	2.28	.00078	.00028	2.8
6	.00091	.00028	3.25	.001	.00030	3.38
8	.00124	.00031	3.98	.00128	.00032	3.95
10	.00156	.00035	4.49	.00152	.00036	4.3
12	.00189	.00042	4.5	.00173	.00041	4.35
14	.00214	.00048	4.55	.00199	.00044	4.54
16	.00232	.00056	4.1	.....	.....	.....
18	.00237	.00066	3.58	.00231	.00055	4.15
20	.00244	.00080	3.03	.....	.....	.....
22	.00254	.00093	2.74	.00250	.00072	3.44
24	.00254	.00102	2.49	.....	.....	.....
26	.00253	.00116	2.18	.....	.....	.....
30	.00262	.00142	1.84	.....	.....	.....
35	.00262	.00169	1.55	.....	.....	.....
40	.00255	.00197	1.29	.....	.....	.....

In conclusion, it is thought that while the above experiments will be found highly interesting to those interested in soaring flight, further experiments with larger birds, as the gull, buzzard, etc., will provide far more comprehensive data on the subject.

Norwegian Aero Model Club

Nearly a year ago, a group of flyers, engineers and others interested in aeronautics in Christiania, Norway, formed a club called the "Norsk Aeromodel Klub" or the "Norwegian Aero Model Club."

The club has an insignia which can be worn only after a member is proficient enough in model building to gain at least 575 points or merit marks, according to the rules arranged for the purpose of awarding such marks. The insignia is a garland wreath tied with a bow of ribbon at the bottom and with a small shield at the top; in the shield are the initials "N. A. K." and at the center of the wreath is a soaring bird with wings outstretched beyond the wreath.

A competition for the awarding of merit marks was held last October 9th. A model constructed by Mr. Harald Gulbrandsen, member of the management of the club, gained 936 points. The model flew 103 metres. The secretary of the club, Mr. Henry Stub, has the best model, the "H-723," which flew a distance of 170.57 metres.

The members of this club are anxious to hear from the various clubs and others interested in models in the United States.

A Compressed Air Driven S.E.V. Scale Model

Among the many scale models built in the last five years by Mr. Richard Sanchez of 1572 73rd Street, Brooklyn, N. Y., are JN-4s, de Havilland 4s, Christmas Bullet, Nieuports, Spad, Curtiss flying boat, Sopwith, Bleriots, Taubes, Albatross and an S.E.V. The S.E.V. was built from the plans published in *Aerial Age* but differs from the plans in the matter of power, for the Sanchez model is driven with a compressed air engine. Mr. Sanchez has, moreover, carried out extensive experiments with compressed air engines and has, at present, three rotaries and two 2-cylinder opposed engines as well as three air tanks.

The specifications of the S.E.V. model are as follows:

Specifications

Span	42 inches
Chord	8¼ inches
Propeller	16 inches
Engine	2 cyl. opposed, ¾-inch, ¾-inch bore and stroke
Pressure	150 pounds
Distance of flight	150 ft. R.O.G.
Weight	28 ounces

Fuselage

The longerons are of 3-16" spruce. The tank is tapered. This enables it to be incorporated very neatly in the fuselage. The motor is mounted directly in front. The fuselage covering is of aluminum and veneering. A cockpit and wind shield are furnished. The whole fuselage is given a coat of grey paint and three coats of varnish. A dummy Hispano-Suiza motor of balsa wood is installed.

Wings

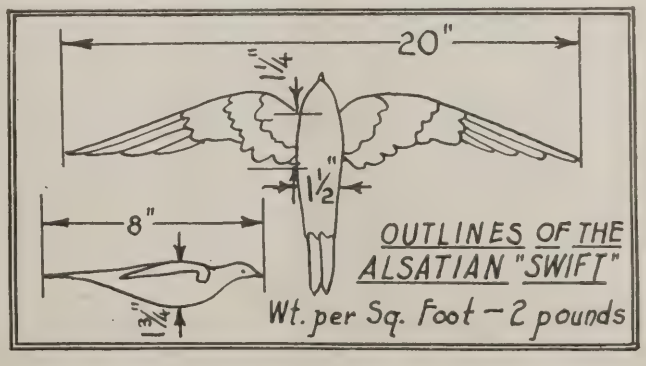
The wings are of orthodox construction. They are painted grey and varnished.

Engine

The motor is a two-cylinder opposed type. It swings a sixteen inch propeller at a rate of 2,000 R.P.M. The tank is equipped with a filling valve, a control valve, and a safety valve which can be adjusted to a pressure of 150 lbs. The whole compressed-air equipment was manufactured by the Model Machine Shop of 415 East 71st Street, New York City.

General

The entire machine is painted a service grey and has the official U. S. Army insignia on the wings and rudder.





Roving the Sky

By L. L. De Jean

Oh, come with me, and let us flee
From folks down here below;
Once in my plane, we soon will gain
Where no one else can go.

We first will chase, and then will race
The eagle in his flight;
Thro' heaven's realm I'll lift our helm
Until we're miles in height.

Up there I'm king, and we will sing
For joy that we are free;
And we'll look down on field and town;
We'll fly o'er land and sea.

Once there, we'll reign o'er our domain
More absolute than Jove
In ancient times, 'mid Grecian climes,
When great Olympus throve.

Let's go away this very day,
If only for an hour,
And skyward stray, thro' cloudy spray,
To heaven's sunny bower.

Let's go and try to verify
The tale of rainbow's end;
A pot of gold we may behold,
We'll bring it home to spend.

Or, better yet, we'll just forget
The way back to this earth;
A call we'll pay the Milky Way,
And there we'll seek a berth.

We'll roam afar until a star
Invites us to remain
And be his guest the while we rest;
Then on we'll rove again.

This world's too small; I've seen it all,
And now I want to go
To see some more, and to explore
The worlds we do not know.

We Are Unusual Men

Nothing to spend but cash,
Nothing to eat but chow;
Chicken, turnovers and hash,
Spuds and fricasseed cow.

Nowhere to go but out,
Nowhere to stay but in—
It's awful beyond a doubt
And I am growing thin.

Nothing to see but shows
Over and over again;
But we all get tired of those
For we are unusual men.

Nothing but words to say,
Nothing to hear but sound;
Same thing, day after day
Until your bean goes round.

We work and we eat and we sleep,
And line up to draw our yen;
We don't get a deuce of a heap
But—we are unusual men.

Shortest Poems

Saw a queen
Limousine;
Didn't look
Good book
Taps.

Another

Night,
Fight;
Blows,
Nose;
Gore,
Roar;
Cop:
"Stop!"
Talk,
Walk;
Cell,
"H——l!"

"Another One"

Please don't judge us by tradition,
Rather by the flag we serve;
We'll make up for lack of culture
When the needed thing is nerve.
And I know they'd be more happy
If my shipmates knew that they
Carried with them the well wishes
Of the whole darn U. S. A.

—*Nick Kenny, U. S. S. Arizona.*

Home Brewtality

A local man tried some of his homebrew on the cat the other night and the animal rose up and whipped a 12-inch electric fan in one round.—*Eldorado Times.*

Two on a sofa
Shoulder to shoulder
Algy becoming
Just a bit bolder
Closer and closer
Hearts madly beating
Smack goes a—lock
Enter, Dad from the meeting

A man I know kicked up a row,
That stirred the neighbor's wrath.
He walked up to a lady cow,
And slyly pinched her calf.—*Gargoyle.*

You may be the world to your mother, but you give me a pain in the neck.

A pretty face is like a melody, but we would all like to sing it in A flat.

A good piano player will always give you a good run for your money.

Little Proverbs

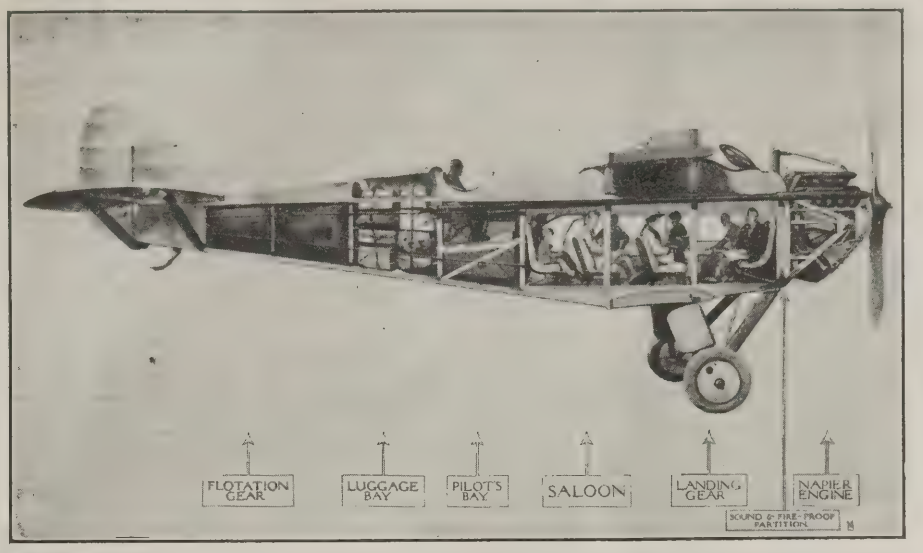
A fool and his honey are soon parted.
All is not pups that litters.
A rolling stone knows no boss.
Still whiskey ruins sleep.
When papa comes in at the door, love flies out the window.

Mary wore a little skirt
Indeed that swept the walks,
She did not camouflage her face
Nor did she roll her sox.
And yet the men in Mary's town
Classed her among the chiques,
For Mary wore that little skirt
In eighteen-ninety-six.

Serénade

My whole month's salary went
To buy my wife a hat;
We had an argument—
I used a baseball bat.
She sleeps,
My lady sleeps,
Sleeps.

THE DH18



The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

AMERADA ENGINEERING CORP.

505 FIFTH AVENUE
NEW YORK CITY

(*Continued from page 422*)

The following figures include everything but administrative overhead and advertising. Those items are not included, because in our case we have spent thousands of dollars in national publicity endeavoring to call to the public's attention the possibilities of aviation. These boats have been used to a large extent in that work—in fact, the expense of a trip from Key West up the coast to New York, and around the Great Lakes and down the Mississippi is all included in our administrative overhead and advertising, and should not be a part of any commercial aviation company's expense, doing strictly a passenger and freight carrying business.

Therefore our figures show the actual operating costs and the possible profits, operating to capacity four hours per day:

Cost of Operating an HS2L Six-Passenger Aeromarine Navy Flying Boat With Liberty Motor

45 weeks per year
4 flying hours per day
5 days per week
Valuation, $7,500
Life of motor, 800 hours
Life of boat, 3 years
Insurance, 32%
Interest, 7%
Gasoline consumption for Liberty motor, cruising speed, 27 gals. per hour
Oil consumption, cruising speed, 1½ gals. per hour

Oil	$0.80 per gallon
Gasoline	$0.25 per gallon
Pilot	$75.00 per week
Mechanic	$45.00 per week
Bowman	$30.00 per week

Cost per flying hour, including pilot, mechanic, fuel, maintenance, depreciation, insurance and interest....$29.98

INCOME

Figuring 5 *passengers* per load at $10.00 per passenger	$ 50.00	
4 flights of 10 minutes each	200.00	per hour
4 hours per day	800.00	per day
5 days per week—20 flying hours	4,000.00	per week

TOTAL INCOME

Figuring 5 passengers per load	4,000.00	per week
Total cost	599.72	
This allows liberally for administrative expense, advertising and dividends	$3,400.28	

Cost of Operating an F5L Eleven-Passenger Aeromarine Navy Flying Cruiser With Twin Liberty Motors

45 weeks per year
4 flying hours per day
5 days per week
Valuation, $30,000
Life of motors, 800 hours each
Life of boat, 3 years
Insurance, 32%
Interest, 7%
Gasoline consumption for Liberty motor, cruising speed, 27 gals. per hour
Oil consumption, cruising speed, 1½ gals. per hour

Oil	$0.80 per gallon
Gasoline	$0.25 per gallon
Pilot	$75.00 per week
Mechanic	$45.00 per week
Bowman	$30.00 per week

Cost per flying hour, including pilot, mechanic and Bowman, fuel, maintenance, depreciation, insurance and interest....$71.12

INCOME

Based on prevailing charges—either $40.00 per flying hour or $10.00 per 10-minute sightseeing flight.

Figuring 9 *passengers* per load at $10.00 per passenger for 10-minute flights	$ 90.00	
4 flights of 10 minutes each	360.00	per hour
4 hours per day	1,440.00	per day
5 days per week—20 flying hours	7,200.00	per week
Figuring 5 *passengers* per load at $10.00 per passenger for 10-minute flight	50.00	
4 flights of 10 minutes each	200.00	per hour
4 hours per day	800.00	per day
5 days per week—20 flying hours	4,000.00	per week

TOTAL INCOME

Figuring 9 *passengers* per load	7,200.00	
Total cost	1,420.00	
Balance	$5,779.42	

TOTAL INCOME

Figuring 5 passengers per load	4,000.00	
Total cost	1,420.00	
Balance	$2,580.00	

These balances allow liberally for administrative expense, advertising and dividends.

TITANINE

TRADE MARK

DOPES AND COVERING MATERIALS

Can be obtained through

JOHNSON AIRPLANE & SUPPLY CO.		Dayton, O.
F. J. LOGAN	712 Superior W.	Cleveland, O.
N. STEELE		Denver, Colo.
F. C. AYARS	Box 294	Beaumont, Calif.
JAMES LEVY	2055 Indiana Ave.	Chicago, Ill.
DE LUXE AIR SERVICE		Asbury Park, N. J.

Made by

TITANINE, Inc., Union, Union County, N. J.

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

PHILADELPHIA AERO-SERVICE CORPORATION

636 Real Estate Trust Bldg. **Philadelphia**

NOW AVAILABLE FOR YOUR AUTO

"The Plug That Cleans Itself"

Saves Gas **B-G** More Power

GUARANTEED CARBON AND OIL PROOF

Recognized as the best for aeroplanes, its success for automobiles is assured

B - G CORPORATION
33 Gold St., New York

If your dealer cannot supply you, send us his name and $1.00 for each plug, stating name and year of manufacture of your car.

SPECIAL OFFER

New wheels with casing and tube

$12.00 comp. F. O. B. Buffalo

Canuck JN4 and 0X5

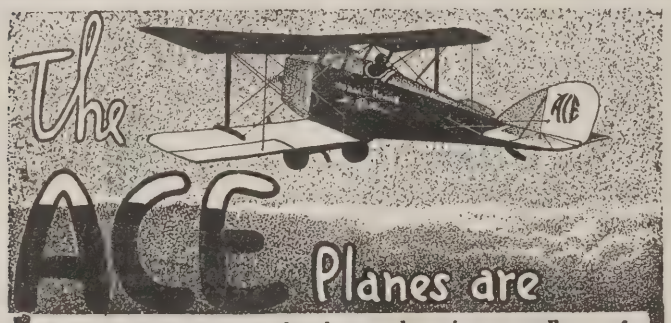
Spares and Supplies

Special prices from now until end of season. Act quick, don't wait until Spring to refit; use your spare time in the winter season.

Write us direct for quotations

ERICSON AIRCRAFT LIMITED

120 King Street E. **Toronto, Canada**



Built for the man who loves the air regardless of the business that calls him.

AVIATION SCHOOLS!
Solo students on the ACE

HORACE KEANE
Aero Planes
Sales Office: 505 Fifth Ave., N. Y. Factory: North Beach, Long Island

Protect papers from prying eyes

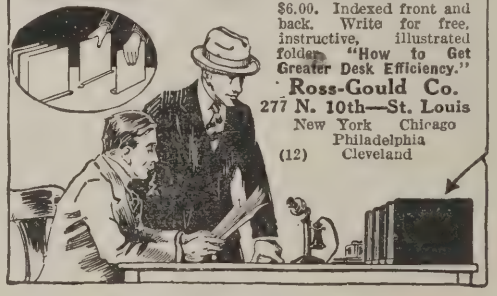
Guard against damage from prying eyes and the unconscious glance of visitors at your desk. It is convenient and efficient to always file confidential papers in a

Kleradesk

Filed vertically, important documents cannot be read; are out of way but immediately at hand when needed.

A Steel Sectional Device

Add compartments as required. Sections $1.20 each. Four-compartment Kleradesk illustrated below only $6.00. Indexed front and back. Write for free, instructive, illustrated folder, **"How to Get Greater Desk Efficiency."**



Ross-Gould Co.
277 N. 10th—St. Louis
New York Chicago
Philadelphia
(12) Cleveland

L. P. WITHERUP

Mechanical Designing Engineer

Specialist on

Lubrication and Bearing Problems. I Make Your Own Bearings or Bushings Work Without Heating.

DESIGNING
DEVELOPMENT
DETAILS
DELIVERY
} of { Internal Combustion Engines of any type, class or service. Airplanes to Farm Engines. Invention Devices, Manufacturing, Air Compression, Pattern and Machine Work.

If you have a two-cycle engine giving you trouble or will not develop its full power, write me particulars and I will straighten it out.

LOCK BOX 1472, CINCINNATI, OHIO

IN order to make room to start manufacturing our three place $2500.00 American product of high efficiency and economy airplane we offer new linen and cotton covered Canuck wing panels at $100.00 each. New rudders, new elevators, new ailerons, each $16.00. OX5 motor parts 50% off. New propellers —each $17.50, OX5.

PARKER AIRCRAFT CO., Perry, Iowa

January 16, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 19

TABLE OF CONTENTS

The British Helicopter Prize..... 435

No Limitation on Aircraft 435

The News of the Week..... 436

The Aircraft Trade Review..... 437

British Test for Aircraft Engines.. 438

The "Sylphon" Fuel System for Liberty and Wright Engines 440

The Truth About Commercial Aviation 442

The Choice of Wing Sections for Aeroplanes 443

Naval and Military Aeronautics... 447

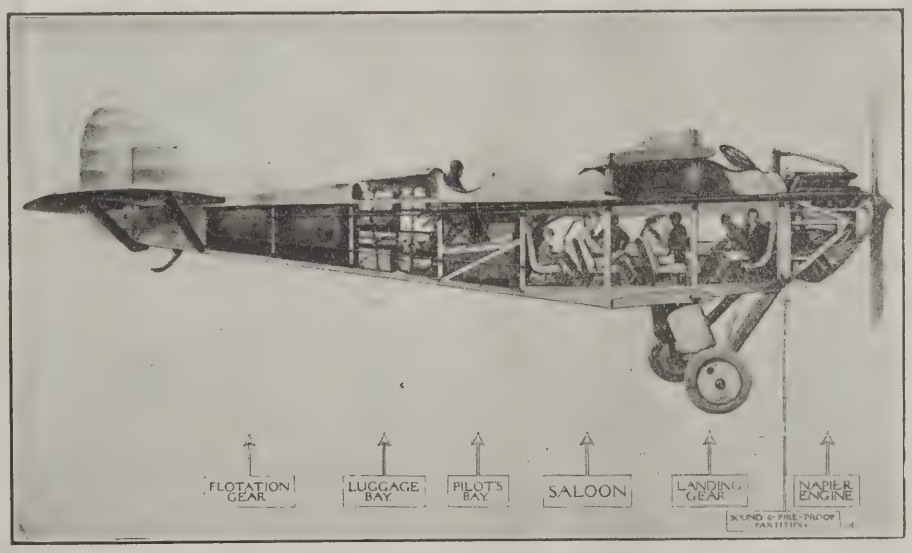
Foreign News 448

Elementary Aeronautics and Model Notes 449

Aeronitis 450

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

THE
DH18

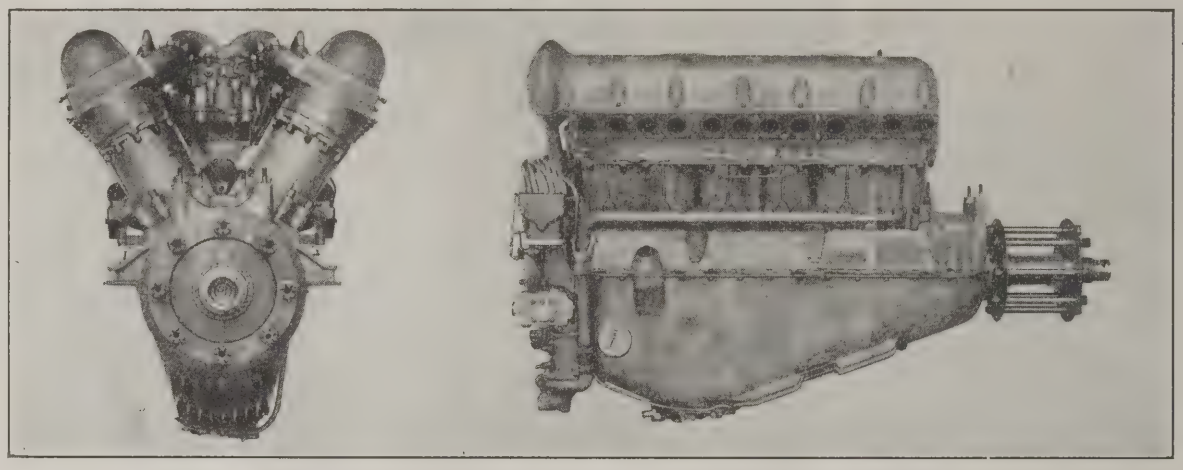


The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

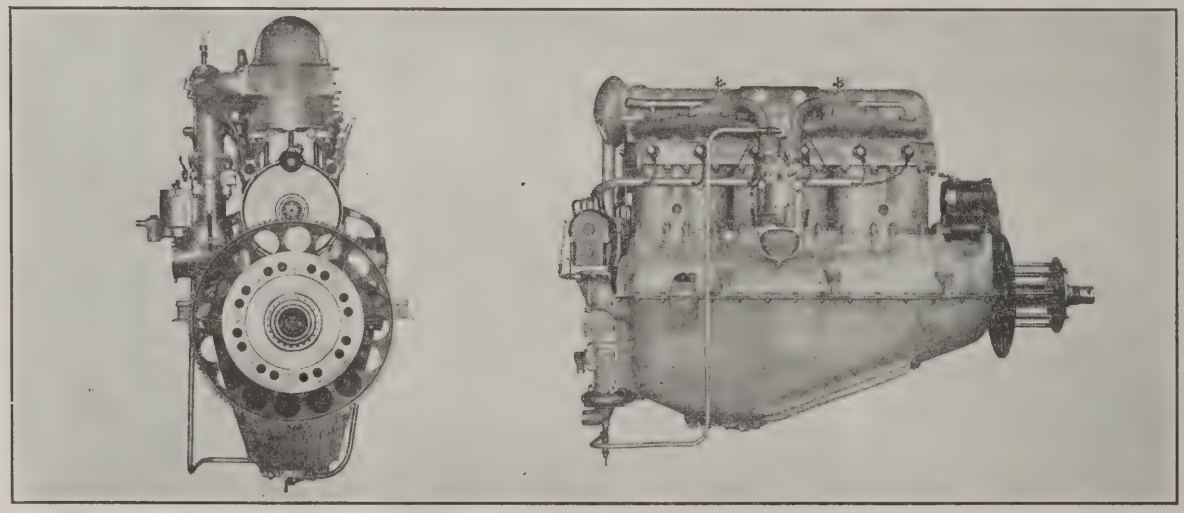
AMERADA ENGINEERING CORP. 505 FIFTH AVENUE NEW YORK CITY

Curtiss



"CURTISS" MODEL CD-12 AVIATION ENGINE

Number of cylinders	12	Weight dry but complete	700 lbs.
Arrangement and angle of cylinders	60° vee	Weight of jacket water	38 lbs.
Water or air cooling	Water	Piston displacement	1145 cu. in.
Bore	4½ in.	Brake M.E.P. per sq. in.	135 lbs.
Stroke	6 in.	Compression ratio	5.7:1
Brake Horse Power	385	INSTALLATION DIMENSIONS:	
RPM of crankshaft above BHP	2000	Overall length	58⅛ in.
Reduction gear ratio	Direct Drive	Overall height	37½ in.
Gasoline per hour	32.1 gals.	Overall width	28¼ in.
Gasoline per BHP hour	.50 lbs.	Height above engine bed	21½ in.
Oil per BHP hour	.015 lbs.	Thickness of engine bed	1½ in.



"CURTISS" MODEL C-6-A AVIATION ENGINE

Number of cylinders	6	Weight dry but complete	420 lbs.
Arrangement and angle of cylinders	Vertical	Weight of jacket water	19 lbs.
Water or air cooling	Water	Piston displacement	572.5 cu. in.
Bore	4½ in.	Brake M.E.P. per sq. in.	128 lbs.
Stroke	6 in.	Compression ratio	5.2:1
Brake Horse Power	160	INSTALLATION DIMENSIONS:	
RPM of crankshaft above BHP	1750	Overall length	57 19/32 in.
Reduction gear ratio	Direct Drive	Overall height	40¾ in.
Gasoline per hour	13 1/3 gals.	Overall width	23 3/32 in.
Gasoline per BHP hour	.50 lbs.	Height above engine bed	24 11/32 in.
Oil per BHP hour	.015 lbs.	Thickness of engine bed	1½ in.

CURTISS AEROPLANE & MOTOR CORPORATION

Garden City, Long Island, New York

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., January 16, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, JANUARY 16, 1922 No. 19

The British Helicopter Prize

THE British Air Ministry's offer of a prize of £50,000 for a helicopter is detailed and specific. The machine must rise to a height of 2,000 feet under its own power, remain stationary for half an hour in light to strong winds, maintain a horizontal flight at a speed of sixty miles an hour, and land by vertical movement with the engine cut off. This is a recognition of the study now being made in many countries to design a practicable helicopter. The British Air Ministry must know in a general way what the inventors are doing. Its offer would not be made if the Hanschk helicopter had solved the problem. A dispatch from The Hague recently said: "The Hanschk helicopter makes 500 kilometers (312 miles) an hour, can ascend and descend vertically, remain stationary in the air, and cannot fall." The inventor has declared that he could fly it to New York in one day. He talks of winning the million-dollar prize for a flight around the world. If it is true that Colonel Williams, chief of the British Aviation Commission, examined a model of this helicopter in Berlin and believed it to be practicable, why is the British Air Ministry making an attractive offer for a machine that will do much less than is claimed for the child of Herr Hanschk's brain?

Designers have long been at work upon helicopter models. It must always be an ungainly looking machine, judging from pictures. The helicopter is expected to rise straight up and go straight down, as well as to fly horizontally at a greater speed than the aeroplane. Among the inventors who are supposed to have come near success are, besides Hanschk, Pescara, of Argentina, Petroczy, an Austrian, and the Frenchmen, Peugeot, Lacoin and Damblanc. The combination of the Greek words helix, a spiral or screw, and pteron, a wing, from which the name of the queer flying machine is made up, explains the task of the inventors. They must provide the machinery to operate screws and wings (planes) so that the car of the pilot may be lifted or lowered vertically and by a change of gear made to move horizontally. The device of the aeroplane propeller is simple by comparison. Petroczy's helicopter was lifted straight up with a crew of four men, and it hovered almost stationary. Afterward it came to grief. To raise it, two vertical propellers were concentrically arranged on a mast. Two masts are used on what is called the Oehmichen-Peugeot type. A motor of not very high power, as yet, is used on all the helicopters. The problem of lifting seems to have been solved; that of driving them horizontally is another matter. It has been said by enthusiasts that the helicopter will some day come into general use as the automobile of the air. Considering what has been accomplished with the aeroplane in eighteen years, who will venture to assert that the helicopter is the stuff that dreams are made of?—Editorial in *N. Y. Times.*

No Limitations for Aircraft

THE Conference on the Limitation of Armaments has unanimously adopted a resolution that "it is not at present practicable to impose any effective limitation upon the numbers or characteristics of aircraft, either commercial or military." Air craft include dirigibles, although the use of dirigibles in commerce is not now considered very seriously. It is true that the Germans talk of an Atlantic passenger service by lighter-than-air ships, but gales and electrical storms would probably make it hazardous at the present state of the art. As a war machine, however, the dirigible is considered to be indispensable. Carrying many tons of high explosives, it could be terribly destructive. Protection to the dirigible might be afforded by a fringe of aeroplanes. It is to be regretted that the conference placed aeroplanes and lighter-than-air ships on the same plane as regards limitation. Because dirigibles might be put to commercial uses, not because they were actually being employed extensively, there was to be no attempt to restrict them as war machines.

Now aeroplanes are being employed extensively to carry passengers, express and freight. In the United States, where aviation does not have as much encouragement as it receives in Great Britain and on the Continent, civilian flying increased 20 per cent. in 1921 as compared with the preceding year. About 1,200 aeroplanes, it is estimated, were operated in 1921, and, according to Captain E. V. Rickenbacker, who made the statement at the dinner of the Aero Club on Monday night, the number of miles flown was 6,500,000. Rear Admiral W. F. Fullam (retired) did not exaggerate when he said at the Aero Club dinner that if the United States had a properly equipped air force no enemy fleet could come within 200 miles of the coast. The Admiral believes—and he has plenty of company in the navy—that the bombing aeroplane has rendered the capital ship practically obsolete. Therefore a ten years' construction holiday is no great sacrifice for any sea power. The aim of every one will be to make preparations for war in the air and not be caught napping. There is a certain consolation, and room for hope that war may be made unattractive, in the proposal of another conference to regulate the use of aircraft in warfare.



THE NEWS OF THE WEEK



Conference Aircraft Experts Submit Their Report

Washington.—The final draft of the report of the arms conference sub-committee on aircraft was completed Dec. 31 and submitted for consideration by the conference. The discussions in the sub-committee are known to have brought out the feeling among the representatives of all five Powers that no impediment should be put in the way of commercial development of aircraft such as might result from an attempt to prevent creation of an air force in each country quickly convertible to war machines at need.

It has been contended by some experts that in fostering development of a new and swift means of communication and transportation the governments represented at the Washington Conference would be taking a very direct step toward lessening the probabilities of wars.

Scholars are said to be agreed that uneven distribution of natural resources among nations has been the underlying cause of most wars. Another war promoting factor, it has been held, has been misunderstandings between peoples due to lack of adequate communication facilities between countries.

In the probable development of air navigation may lie a cure for these fundamental and hitherto unavoidable seeds of war, it has been said. Through air transportation most experts expect to see wider access to natural resources of the world made possible and a consequent lessening in the struggle for actual physical control of those resources.

Effective Work by Airmen at Ottawa

Ottawa, Can.—Seaplanes and aeroplanes on the Ottawa (Rockcliffe) station spent over 85 hours' flight during two months' activity in the late summer and autumn this year, according to a report of the Air Board just compiled. Tests were carried out in the vicinity of the Capital with a gyroscopically controlled camera, as a result of which, improvements to the camera are now being made. A photographic survey of the Gatineau Valley was also made for the geodetic survey branch of the Interior Department. The airmen from the Ottawa station also did survey work along the St. Lawrence and in Northern Ontario.

Flying Club of St. Louis

The new flying field of the Flying Club of St. Louis, Mo., was officially opened on December 12. The field is located at Bridgton, eight miles from the city limits of St. Louis. It has an area of about 180 acres, and there is a large hangar on the field for use of the members. The exhibition flying for the opening was done by Wm. Robertson and Ray Wassall.

Arkansas City Aerial Police

Arkansas City, Kansas, secured its first units of an aerial police force when Mayor C. N. Hunt recently appointed W. H. (Pete) Hill as chief of the aerial police, and Cecil J. Lucas as his aide. Mr. Hill is distributor for the State of Kansas for the Curtiss Company.

Arkansas City is one which has foresight enough to see the possibility of aviation. There are a number of ships which operate out of this town, besides several privately owned ships. There is a large landing field and gas, oil and supplies are always available to all aviators, who are welcome in Arkansas City at any time.

Find Unknown Lakes in Jasper Park, Alta.

Ottawa, Can.—Several hitherto unknown lakes and river valleys have been discovered in Jasper Park, Canadian Rockies, through the use of government aeroplanes. This work was undertaken by the High River Air Station, Alberta, and three experimental flights were carried out over the region for the purpose of exploration and photographic reconnaissance. With the aid of the plane the unknown lakes and rivers were accurately located and valuable information was secured as to the possibility of breaking new trails through the district. Complete reconnaissances were made of mountain peaks, valleys and mountain passes. Information was also secured as to the extent of the timber in the park and communication was kept up with construction gangs working several days' foot journey from the nearest telephone.

Senator Borah and the Mitchell Report

Washington.—All the vital points in the bomb-testing report of Gen. William Mitchell will be laid before the Senate. Senator Borah said on Jan. 4 that when the Naval appropriation bill comes up he will make public the opinions of Mitchell, which were that the battleship is helpless before aerial attacks.

The Senate recently adopted a resolution offered by Borah calling upon Secretary Weeks for the Mitchell report on the bomb-dropping experiments off the Virginia Capes some time ago.

On the ground that it is "incompatible with the public interest," the Secretary informed the Senate he had been directed by the President not to transmit the report.

Immediate notice was given by Borah that he did not consider the publication of the report as "incompatible with the public interest." He called attention to the fact that after the bombing tests one report was given out and widely distributed.

"That report, as I understand," said Borah, "was altogether favorable to one theory of the experiments. Another report was filed which was quite in conflict with that theory. It was filed by Gen. Mitchell. If it should be found to be true that Gen. Mitchell's theory is the correct one and the facts which he gives support his theory, the first report was wholly misleading."

Borah contended that if the first widely published report was in the public interest then the report in contravention of it is entitled to be weighed by the public at the same time.

"The report of Gen. Mitchell might materially affect some of the reputations of those who have been passing upon the efficiency of modern battleships, but it would be very interesting to the taxpayer," he said.

"I think I know practically what is in the report and I will state what it is, and if incorrect I shall rely on the Secretary of War to correct the statement."

Pioneer Instrument Takes Over K-L Fuel System

The Pioneer Instrument Co., of Brooklyn, have taken over the manufacture and sale of the K-L Fuel System formerly handled by the K-L Automotive Specialties Co. Mr. C. B. Kirkham will continue to supervise the engineering work in connection with the apparatus and its installation. This fuel system was described in AERIAL AGE for August 8.

CALENDAR OF COMING EVENTS

under sanction of

AERO CLUB OF AMERICA

April 30th (1 or 2 days)

Spring Show and Opening Meet

Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for

Detroit Aerial Water Derby

Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy

Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet

Pulitzer Trophy
Detroit Aerial Derby

for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races

Detroit News Aerial Mail Trophy

for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)

In Preparation by the Aero Club of America

American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th

First Annual Interservice Championship Meet

Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)

Foreign Events

Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)

Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

American Firm Orders Ocean-Flight Plane

Paris.—An American firm has just ordered an aeroplane of the type described by Louis Breuget, a famous French flier and constructor, as "an ocean-crossing plane." M. Breuget recently predicted that these aeroplanes will be making frequent trips across the Atlantic within two or three years. They are now under construction.

They are expected to be able to fly twenty-four hours without stopping, at a speed of 180 miles an hour, and to carry twenty or thirty passengers, with baggage. This would bring the two continents within a day's travel of each other.

The planes are being planned with huge wings, six feet thick, the interior of which will be used for cabins. As described by M. Breuget, their total weight will be 155 tons, their wing-spread 375 feet, and they will have twenty-four motors of 500 horsepower each.

"There is no reason why an aeroplane could not make the circuit of the world without a stop. if we pursued the formula as to weight-lifting and speed and if greater room can be found for fuel, say 70 per cent. of the total lifting power," says M. Breuget. "Such a plane would travel at a speed of 750 miles an hour, but this speed would be impossible unless an average height of 42,000 feet could be maintained. At such a height the atmosphere has one-fifth of its ordinary density.

"The vista spread out by such a possibility is amazing. Man could fly around the earth faster than the earth's movement. He could, so to speak, catch up with the sun. New York would only be six hours from Europe. Again, in the case of war, what would be the use of big fleets if they were faced with huge 100 and 200 ton aerial torpedo planes? The navies of the world will then be relics of the past, fit only for a place in a museum next, let us say, to mammoths.

"People laugh at these predictions," ended M. Breuget, "but so did people in 1840 when steam navigation was introduced."

Roland Rohlfs Joins Aeromarine

Roland Rohlfs, the famous American pilot and holder of several aeronautic world's records, has joined the Aeromarine Airways, commercial aviation organization, according to an announcement by C. F. Redden, president of the Airways Company. Rohlfs is leaving for Florida, where he will take part in the winter operations to and from Florida coast resorts and points in the West Indies.

"Roland Rohlfs has probably tested more aircraft than any other American pilot," says an official of the company. "Up to the present he has specialized chiefly on military and naval types of aircraft, but like all men experienced in the aeronautical industry, he realizes that the greatest possibilities in aerial activities in this country now rest in commercial aviation and he has chosen America's largest aerial transportation organization for his career.

"The Aeromarine Airways is glad to have Mr. Rohlfs in its organization, and his engagement is part of the Airways' policy to build up a staff of trained and efficient personnel in order to maintain its record of safety and efficiency."

New Goodyear Sales Manager

William C. Young, well known in aero circles, has just been made manager of aeronautical sales of the Goodyear Tire & Rubber Company, succeeding Willard P. Seiberling. Mr. Seiberling, who was aide on the balloon "City of Akron" in the 1921 international balloon race, has joined the new Seiberling Rubber Company established by his father, F. A. Seiberling, former Goodyear president.

Mr. Young is a native of Ohio, a graduate of Hiram College, and won an engineering degree from the University of Virginia in 1915. During the war he qualified as a balloon and dirigible pilot, was stationed for a time at Wingfoot Lake Air Station, Akron, and later was sent to Europe by the U. S. Signal Corps to study aero developments in the war zone. He is a member of the Aero Club of America and the Akron University Club. He has been assistant manager of aero sales at Goodyear since the war.

Air Service Bids

Aeroplanes.—Office of the Chief of the Air Service, Washington.—Bids are wanted until 2:30 p. m., January 31, for item 1, 25 standard bombardment aeroplanes with twin Liberty engines complete; 2, 50 do; together with a quantity of spare parts. Blueprints and specifications covering the proposal will be furnished upon receipt of an application from manufacturers considered to have adequate plant facilities and experience in aeroplane construction if accompanied by a certified check in the amount of $150, made payable to the Chief of the Air Service, to guarantee return of blueprints and specifications within a period of 10 days from date of receipt. Detailed drawings are to be furnished to the successful bidder by the Government.

Aeromarine in the South

Operations in the South have commenced and the Aeromarine Flying Boat Line between Key West and Havana is proving very popular. Within the next week regular service between Miami and Palm Beach and Nassau, in the Bahama Islands, will be inaugurated by the Aeromarine Company.

The Aeromarine Airways has numbered among its pilots some of the finest in the country. They are men who have enviable war records and who have turned the knowledge thus gained to commercial aviation. Among the other pilots who were well known are Major B. L. Smith, who was formerly Naval Attache of the American Embassy in Paris. He was one of the first naval pilots and was then transferred to the U. S. Marine Aviation Corp. Another ex-U. S. Marine aviation pilot is Edward Musick, who flew the Aeromarine eleven-passenger air cruiser "Santa Maria" from Detroit to Chicago and thence down the Mississippi River to New Orleans and to Key West.

George Cobb, an ex-naval aviation officer, is again flying one of the eleven-passenger enclosed-cabin Aeromarine cruisers between Key West and Havana.

The U. S. Army Air Service is represented by D. G. Richardson, formerly a lieutenant and instructor. After the cessation of hostilities, Richardson went to Cuba and became chief of the Cuban Air Service, instructing Cuban aviators on Aeromarine flying boats. He joined the Aeromarine forces last spring and during the summer established a world's record for distance in an Aeromarine-Navy flying boat, circumnavigating the Great Lakes and covering 7,491 miles. In September he opened the Aeromarine New York-Havana service, flying an Aeromarine boat to Havana with four passengers. He left again on the regular monthly route from New York to Havana, carrying four passengers.

De Los Thomas is also an ex-Naval pilot, and a few days after joining the Aeramarine organization he flew the Dempsey-Carpentier fight film out to the steamship Caronia, far at sea, successfully transferring the film and returning to his boat. Last month he left New York in an Aeromarine boat with passengers for Havana and is now flying between Key West and Havana.

A Correction

An error has been noticed in the report of the Contest Committee for the Special Class Efficiency Race held at Omaha on Nov. 5, 1921. Planes Nos. 14 and 61, flown by Buck Weaver and Walter H. Beech, respectively, are reported as having used Liberty Aero Oil. Since making the report I have found that these planes used Lakeside Aviation Oil. The C. L. Maguire Petroleum Company has brought this error to my attention and has asked that I publish the correction. (Signed)

IRA A. RADER,
Major Air Service.

Orenco D-2 to Dayton

The Orenco D-2 has been shipped to Cook Field, Dayton, for flight test. The D-2 is the latest type of pursuit fighter and promises well as a speedy fighting craft. No details of its dimensions and performance are permitted to be made public at this time.

Sanford Aviation Training Company

The Sanford Aviation Training Co. has just been organized at Brunswick, Ohio. Budd A. Sanford is manager and W. P. Goebel is flying instructor. The mechanical and rigging courses are under the supervision of Henry Simmerly.

BRITISH TESTS FOR AIRCRAFT ENGINES

THE following schedule of standard tests to determine the airworthiness of aircraft engines, issued by the British Air Ministry, is of interest.

General

This schedule comprises four parts, as below, and includes the bench tests and conditions of testing to which all engines supplied to H. M. Government must comply, as well as the bench tests and requirements of the Secretary of State, in accordance with Air Navigation Directions, A. N. D. I., paragraph 21 (i).

Where the conditions in this schedule refer only to engines to be supplied to H. M. Government, a note (*) to this effect has been added:

Part (a) Conditions of tests, definitions of power, etc.
Part (b) Type tests for new designs of engines.
Part (c) Acceptance tests for new engines.
Part (d) Acceptance tests for repair and rectification engines.

Air-worthiness Certificates

In order that a particular engine may be approved by the Secretary of State as airworthy, it is necessary that a sample type engine (which during manufacture has been inspected in accordance with Air Navigation Directions, A. N. D. I., paragraph 20), shall be submitted to type tests, as laid down in Part (b) of this schedule. On the satisfactory completion of these type tests, the Secretary of State will grant an airworthiness certificate for such engines as a type.

Subsequent production engines will be required to be submitted to bench tests, as laid down in Part (c) of this schedule, and the makers must fulfill the conditions of Air Navigation Directions, A. N. D. I., paragraph 21, in order that each engine may be approved as airworthy. Furthermore, in order to check the conditions of manufacture of such subsequent engines, not more than 2 per cent of these engines, as manufactured, will be required to be submitted to a repetition of the type tests, Part (b). Part (d), though intended to apply to Government contracts only, forms a guide to ground engineers as to the most desirable tests for repaired engines.

Part A.—Conditions of Test, Definition of Power, Etc.

1. *Inspection.*—When so required, tests are to be carried out in the presence of the authorized representative of the Secretary of State, and all necessary facilities must be given to this representative to enable him to carry out observations and inspection.

2. *Suitability of Test Plant.*—The test bed conditions, cooling, method of absorbing and measuring horsepower, measuring revolutions per minute, fuel consumption, water and oil temperatures, etc., must be such as to satisfy the requirements of the Secretary of State.

3. *The Test Plant* employed must be capable of fulfilling the following general conditions:

(a) Variation of the brake torque without stopping the engine;

(b) Measurement of the h.p. developed by engine, by means of the torque reaction of the brake or of the engine;

(c) Adequate cooling of the engine.

In order to meet condition (c) for the purpose of power curves and the adjustment of r.p.m. on full throttle test, a variable torque brake is required.

To meet condition (b), a centrally pivoted torque reaction test bench or a balance torque reaction dynamometer or brake is required.

4. *Cooling.*—(a) Water-cooled engines.—Arrangements made must be such that the outlet temperature of the cylinder jacket water can be regulated and maintained steady at not less than 65° C. when measured close to the engine. The supply of water to the suction pipe of the water pump must not exceed a head of, or a pressure equivalent to, 10 feet.

(b) *Air-cooled engines.*—Arrangements for the cooling of the engines must be such as to represent as closely as possible the atmospheric cooling conditions to which the engine is subjected while in flight.

(c) *Oil-cooling.*—Arrangements must be made on all engines working on a circulating oil system to provide means of cooling the oil, and the intake oil temperature must be adjusted to be not less than 50° C. nor more than 70° C. during the tests.

5. *Power Tests.*—(a) All tests, endurance and final, unless otherwise specified by the Secretary of State, will be carried out at 90 per cent of the full power, and at normal r.p.m. All engines must, however, be opened out to full throttle at normal r.p.m. for the last five minutes of all tests (unless otherwise specified by the Secretary of State), and the b.h.p. developed must not be less than full power when corrected for barometer.

(b) Normal r.p.m. is defined as the maximum crankshaft speed at which the engine may be run for long periods as declared by the maker.

(c) Maximum permissible r.p.m. is defined as the maximum safe speed which the engine may be run at for short periods (say five minutes) as declared by the maker.

(d) Full power is the maximum power as declared by the maker at normal r.p.m. when corrected for barometric pressure at which the engine should be run.

6. *Consumption.*—(a) Fuel and oil consumptions will be measured by the total amounts consumed during the endurance test (no corrections being made for the last five minutes' tests), and if these amounts are not within 20 per cent of the maker's declared rates, the maker may be required to withdraw the engine and re-submit it for test, unless in the opinion of the representative of the Secretary of State the consumption can be corrected by adjustment on the dismantling after endurance test. In this case the consumption readings can be again taken on the final test, which must not be less than one hour's duration for this purpose. Should the engine again fail, it must be resubmitted for the endurance and final tests after adjustment or correction.

(b) Where A. I. D. Mark III flow-meters are fitted to test benches, the mean of quarter-hour readings will be accepted in lieu of actual total petrol consumptions provided sufficient calibrated tanks, etc., are available to make an occasional check on the flow-meter readings.

(c) In all cases check consumption readings will be made on final tests.

(d) All tests should be made with the altitude control on the carburetor fixed in the normal running position.

(e) Fuel consumption will be specified in pints per h.p. per hour, and will be calculated from the actual h.p developed, uncorrected for barometer, and no allowance will be made for the last five minutes' test at full throttle.

(f) *Oil consumption.*—For type test the consumption will be given in pints per h.p. hour. For production engines, the consumption will be specified in pints per hour and not pints per h.p. per hour.

(g) *Petrol.*—The standard maker's figures established for each type of engine will be based on tests carried out on some fuel approved by the Secretary of State.

7. *Thrust Test.*—In order to test the thrust bearings, engines may be required to be submitted to the application of a thrust of 6 lbs. per h.p. to the airscrew-shaft during test. This test may be run during or at the conclusion of the endurance test, and under the same conditions of h.p. and r.p.m. as the endurance test. (Testing by means of a suitable airscrew will be accepted for this purpose, if so desired.) If the engines are to be used only for tractor or pusher machines respectively, the thrust must be applied accordingly. If the engines are to be used for either type of machines, a proportion of the thrust tests must be made in each direction. These tests need not apply to rotary engines or to any type of repair or rectification engine.

8. *Slow Running: Vibration and Acceleration Tests.*—At the conclusion of endurance and final tests while the engines are still warm, observations will be made to ascertain that each engine runs reasonably slowly and opens up the normal r.p.m. within five seconds without excessive "popping" or rough periods of running. Engines will be expected to run reasonably at about 50 per cent reduction of speed from normal r.p.m. when the brake has been adjusted for 90 per cent power at normal r.p.m.

9. *Power Curve Tests.*—(a) The brake must be carefully checked over and adjusted if necessary before these tests, and particular attention given to the accuracy of spring balances and weights.

(b) Readings must be taken every 100 r.p.m. from 400 r.p.m.

below normal r.p.m. up to the maximum permissible speed, and down again to 400 r.p.m. below normal. If the maximum permissible speed is a step of 50 r.p.m., a reading will be taken at this speed also.

(c) The engine must be opened up to full throttle at each speed for about three minutes, so that a steady reading of half-minute's duration is obtained, and not a "snatch" observation taken.

10. *Accessories.*—(a) Engines must be run throughout all tests fitted with the carburetors, magnetos, and accessories which will be delivered with them.

(b) Before delivery, engines must be fitted with the carburetor jets of sizes authorized for flight conditions; these jets will not necessarily be the same as those used on the engine test bench.

Particulars of jet sizes will be found in the A. I. D. Standard Jet List.

11. *Failure on Test.*—The failure of any vital part of any engine during test will be held automatically to reject such engine, and, after replacement or rejection of part or parts, the engine must be re-submitted to tests exactly as a new engine.

12. *Preparation for Despatch.*—Engines which have completed tests, and are prepared for despatch, must comply with the instructions approved by the Secretary of State for the closing of all ports and openings and the prevention of external and internal rust or deterioration while in store.

Part B.—Type Tests for New Designs of Engines

1. *Power Curve.*—A power curve to be taken in accordance with Part A, paragraph 9.

2. *Endurance Test.*—An endurance test of 50 hours' duration at normal speed at (unless otherwise specified) 90 per cent full power to be taken in accordance with Part A, paragraph 5. This endurance test must include two non-stop runs of 10 hours' duration. Before the last hour of the endurance test, the load will be increased, so that the engine is running at full power at normal r.p.m. until the completion of the test.

3. *Thrust Tests.*—The egnine must run for at least 20 hours with a thrust applied to the airscrew-shaft as described in Part A, paragraph 7. This test may be included in the 50 hours endurance test. Such steps should be non-stop runs to not less than 10 hours' duration.

4. *Slow Running and Acceleration.*—The engine must be run in accordance with Schedule A, paragraph 8. The duration of the slow running is to be 30 minutes.

5. *High Speed.*—The engine to be run for one hour continuously at 10 per cent in excess of the established maximum permissible speed and under load conditions at the option of the manufacturer.

6. *High Power.*—The engine to be run for one hour continuously at the established maximum permissible speed and at full throttle.

7. *Power Curve.*—Another power curve to be taken in accordance with Part A, paragraph 9.

8. *Dismantling.*—On the completion of the above tests the engine to be completely dismantled for the inspection of the representative of the Secretary of State. On the completion of inspection any defective or unduly worn parts that have been rejected bust be replaced and the engine re-assembled for test.

9. *Final Test.*—If the condition of the engine has been satisfactory it will require to be submitted to a final test of 30 minutes under the same conditions as the endurance test.

10. *Petrol and Oil Consumption.*—The consumption of petrol and oil must be within 20 per cent of the maker's rating taken on any one non-stop run of ten hours running during the 50 hours' duration test. (See Part A, paragraph 6.)

*11. *Petrol Consumption.*—The consumption of petrol must not exceed .56 pints per b.h.p. per hour hour for water-cooled engines, and .60 pints per b.h.p. per hour for air-cooled engines, which will be defined as the average of the consumption per b.h.p. per hour on each period of the 50-hour endurance test.

12. *Oil Consumption.*—The consumption of oil for water-cooled engines must not exceed .025 pints per b.h.p. per hour; for air-cooled engines it must not exceed .045 pints per b.h.p. per hour. (See Part A, paragraph 6.)

*13. Water Pump Delivery.—Engine water pumps will be required to deliver a minimum of 15 g.p.m. per 100 b.h.p. against a circuit resistance of 6 lbs. per square inch.

The following approximate results may be anticipated from pumps suitable for these requirements:

Hydraulic Resistance of circuit	G.P.M. Per 100 B.H.P.
6 lbs. per square inch	15
4 lbs. per square inch	18½
2 lbs. per square inch	22

The pumps must be capable of delivering some water at a pressure of 10 lbs. per square inch at normal r.p.m.

14. *Petrol.*—Type tests will be carried out on any spirit approved by the Secretary of State.

15. *Oil.*—Tests 5 and 6 will be run with a supply of oil in circulation equivalent to the maximum permissible consumption for four hours. No fresh oil may be added during these tests.

Part C.—Acceptance Tests for New Engines

1. *Running In.*—All engines must be "run in" light for a period of not less than two hours until "free" either under their own power on town gas or by being driven from shafting or some other source of power, the r.p.m. of the engine to be at the discretion of the manufacturer.

2. *Tuning Up.*—All engines must be tuned up on petrol for at least a quarter of an hour before endurance tests, and five minutes before final tests, during which time the maker should verify that the engine will open up to full power and will also run slowly, in accordance with the conditions of test, Part A, paragraphs 5 and 8.

3. *Endurance Test.*—Each engine (unless otherwise specified) will be run for two hours at normal r.p.m. at 90 per cent full power, except for the last five minutes, when the engine will be run at full throttle in accordance with Part A, paragraph 5 (a).

4. *Dismantling.*—On conclusion of the endurance test the engine will be completely dismantled for inspection by the representative of the Secretary of State, or other authorized person, and any worn or defective parts will be rejected and must be replaced. (See Part A, paragraph 11, refailure on test.)

5. *Final Test.*—After re-erection each engine will be run for not less than half an hour under the same condition as for the endurance test. (See Part A, paragraph 7 (a), reincrease of final test to one hour.)

6. *Slow-running Tests.*—At the conclusion of final tests, slow-running and acceleration tests must be made in accordance with Part A, paragraph 8, and should not exceed five minutes' duration.

Part D*—Acceptance Tests for New Engines

1. Running In.—All engines must be "run in" light for a period of not less than one hour until "free" either under their own power or town gas, or by being driven from shafting or some other source of power, the r.p.m. of the engine to be at the discretion of the contractor.

2. *Tuning Up.*—All engines must be tuned up on petrol for at least a quarter of an hour before endurance tests, and five minutes before final tests, during which time the contractor should verify that the engine will open up to full power and will also run slowly, in accordance with the conditions of tests, Part A, paragraphs 5 and 8.

3. *Endurance Test.*—Repair engines will be run for one hour, and rectification engines for at least half an hour at normal r.p.m.., and (unless otherwise specified) at 90 per cent full power, except for the last five minutes, when the engine will be run at full throttle, in accordance with Part A, paragraph 5 (a).

4. *Dismantling.*—On the conclusion of the endurance test, repair engines will be completely dismantled for inspection of the representative of the Secretary of State. Rectification engines will be dismantled as far as it is necessary to examine any enclosed parts which have been fitted in accordance with the rectification schedule. Any worn or defective parts will be rejected and must be replaced. (See Part A, paragraph 11, refailure on test.)

5. *Final Test.*—After re-erection each engine will be run for not less than a quarter of an hour under the same conditions as for the endurance test.

6. *Slow-running Test.*—At the conclusion of final tests, slow-running and acceleration tests must be made in accordance with Part A, paragraph 8.

Note.—A rectification engine is one which has been partially dismantled to embody Class I and II modifications, and has not been dismantled for overhaul or repair.

THE "SYLPHON" FUEL SYSTEM FOR LIBERTY "12" AND WRIGHT MODEL "H" ENGINES

General

The sylphon pump was designed to fill the need for an engine-driven fuel pump in order to obviate the use of air pressure where sufficient gravity head is not available. The name is derived from the metallic bellows, the trade name of which is "Sylphon," which is the characteristic feature of this pump. This type of pump was selected because it requires no packing gland and also because it gives a maximum discharge pressure at high speeds and sufficient fuel at any speed, thus doing away with a relief valve. It is built in duplex form so that in case one pumping unit fails the other unit will maintain sufficient fuel supply for all engine speeds.

Nearly two years of service in flight at McCook Field and a 1,400-hour bench test at full capacity have revealed no failures of any kind. This performance, however, can be expected only when proper care, which is due any mechanism of this nature, is maintained.

At present this pump is produced for use on the Liberty "12" and Wright Model "H" engines. The only difference between the two models is in the drive shaft and base casting flange. The assembly drawing number of the Liberty "12" pump is 047280 and that of the Wright Model "H" is 047281.

General Description

The Liberty "12" pump will be described, but the description for the Model "H" is the same, except that the splined drive shaft (045289) and the base casting (045266) on the Liberty are replaced on the Model "H" by parts numbers 045280 and 045267, respectively. The nut on the end of the magneto drive shaft of the Model "H" must be removed and replaced by nut (045458) which is furnished with the pump. The Liberty pump is driven directly from the crank shaft.

A four-pitch worm (045305) in figure 1 meshes with a 32-tooth worm wheel (045291) giving an 8 to 1 reduction. The worm wheel is attached to a cam shaft (045284), which actuates cam follower rollers (045287) attached to cam followers (045286). The cam followers extend into the sylphon flange (045259) to which the sylphon (045308) is soldered. The upper end of the sylphon is soldered to the sylphon headplate (045436), which is secured in position by machine screws (SP-2446). The sylphon chamber (047277) also contains the inlet and outlet valve assemblies (047282) and (045276), respectively. As the worm rotates the worm wheel in the cam shaft moves the plungers down only, admitting fuel from the main tank to the sylphon, which is returned to its original position by the spring (045282) designed to give a maximum pressure of 4½ pounds per square inch with a closed discharge.

The worm-drive shaft (045289) is threaded onto the worm and butts against the ball bearing. The worm-bearing cage holds the bearing position. The worm-bearing cage retainer is grooved for felt packing to keep oil in the pump, and fits just outside of the worm-bearing cage. The worm-bearing cage (045260) and the worm-bearing cage retainer are attached to the pump base by machine screws. The pump base cap (045302) is the bronze bearing on the other end of the worm.

The cam followers (045286) operate in the cam-follower bearings lower (045304) and upper (045288), which are bronze bushings. The upper bearings are in the cam-shaft support (045264) and the lower bearings in the pump base (045266). The cam shaft operates in aluminum bearings in the cam shaft support.

There are two intake and two outlet valves, each a unit, screwed into the valve chamber, which is the upper part of the sylphon chamber casting. The valve chamber has a partition, on one side of which are the two intake valves, and on the other side the two outlet valves.

A hole, having ⅛-in. pipe thread about one-half way down on one side of the pump, is utilized as a drain in case a gasket leaks or a sylphon breaks.

Two outlets and two inlets are provided for convenience in installation. Only one of each is necessary. The pipe plugs are inserted to prevent dirt getting in the valves in shipping and stocking.

The pipe plug in the bottom of the base is permanent and should be removed only to refill the base with lubricant.

Disassembly

To disassemble the pump, first unthread, but do not remove, screws (SP 2446) on top of the sylphon chamber.

Remove screws which join sylphon chamber, cam-shaft support (045264), and pump base (045266).

Tap lightly on upper screws (SP 2446) until bond between gasket (045429) and sylphon chamber is broken. (This prevents sylphons from being stretched.)

Lift off sylphon chamber (045277).

Carefully lift off cam-shaft support (045264). This part carries the worm wheel and is doweled on to pump base (045266), giving correct alignment with worm (045305).

The worm wheel is removed by unscrewing machine screws (SV 2533).

The worm (045305) can be removed by withdrawing cotter on engine shaft (045289), unscrewing same, pulling worm-bearing cage retainer (045261), worm-bearing cage (045260), and ball bearing, then removing worm (O453O5).

The cam-follower bearings upper (045288) and lower (045304), the pump base cap (045302), and worm bearing cage (045260) are of bronze, pressed in.

The four valve assemblies are in units. These can be removed by means of a broad screw driver.

Installation

The Liberty "12" pump has a splined drive which fits into the rear end of the crank shaft. It is attached by nuts holding it down to six studs on the rear of the crank case. Figure

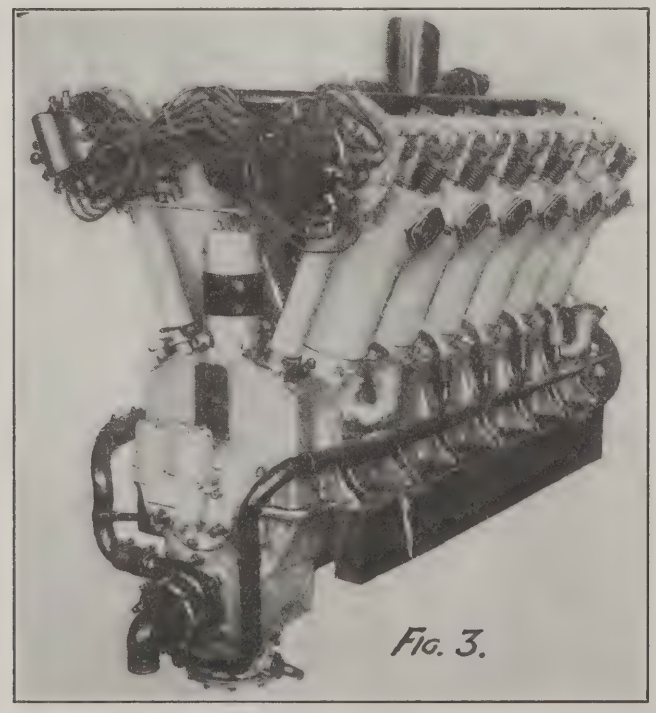


Fig. 2. Pump on Liberty 12 Engine

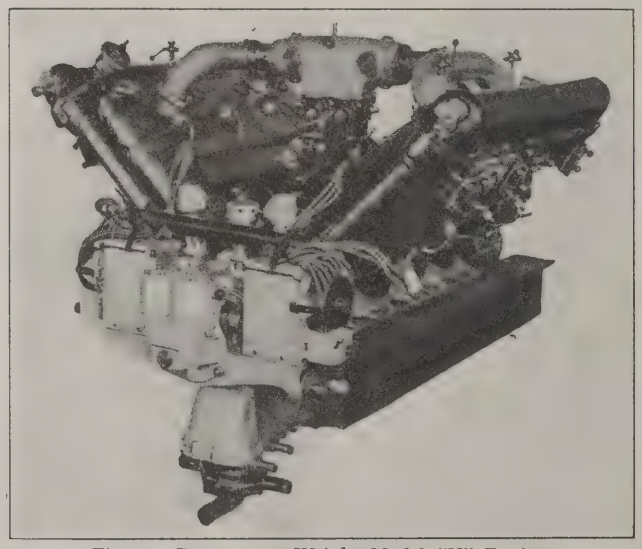


Fig. 3. Pump on a Wright Model "H" Engine

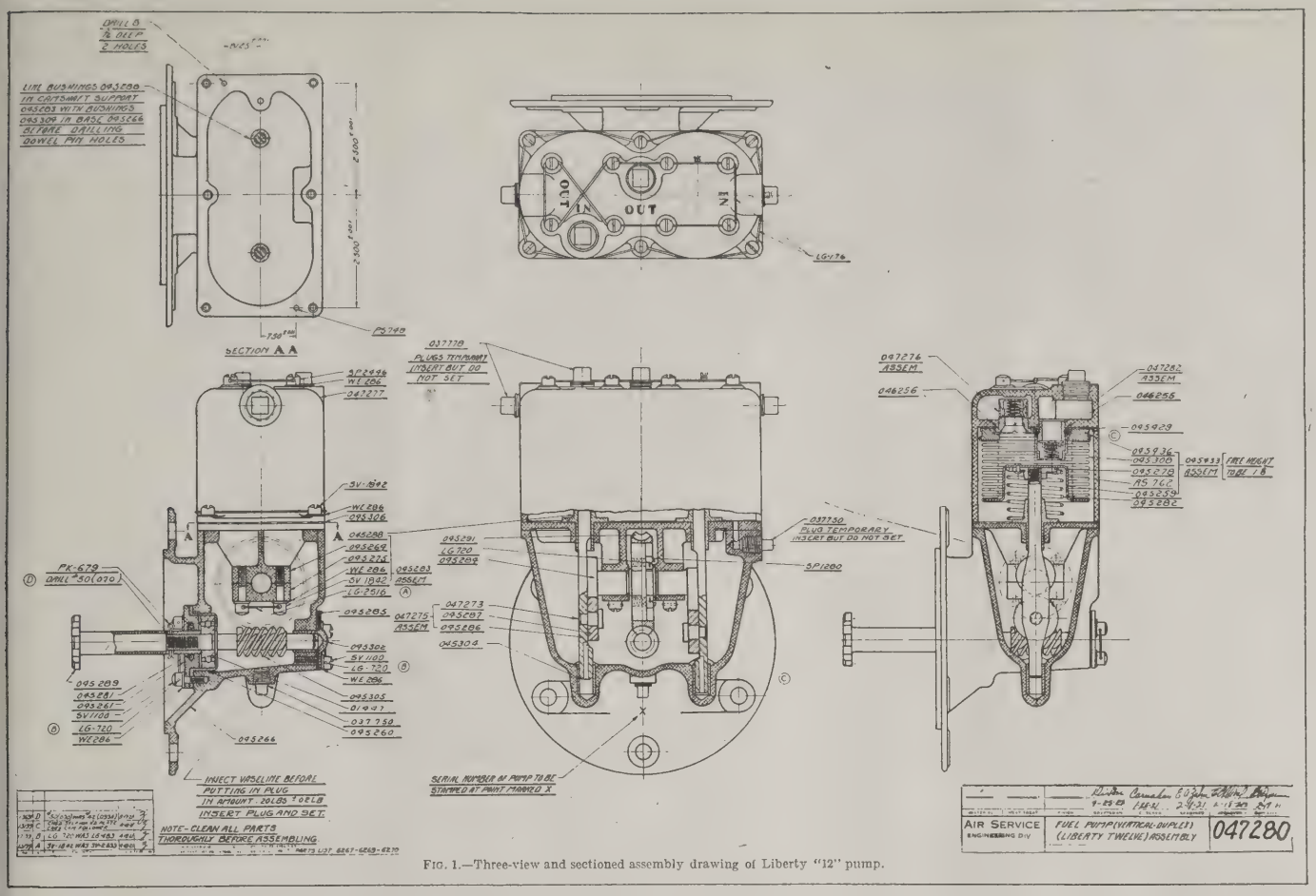


FIG. 1.—Three-view and sectioned assembly drawing of Liberty "12" pump.

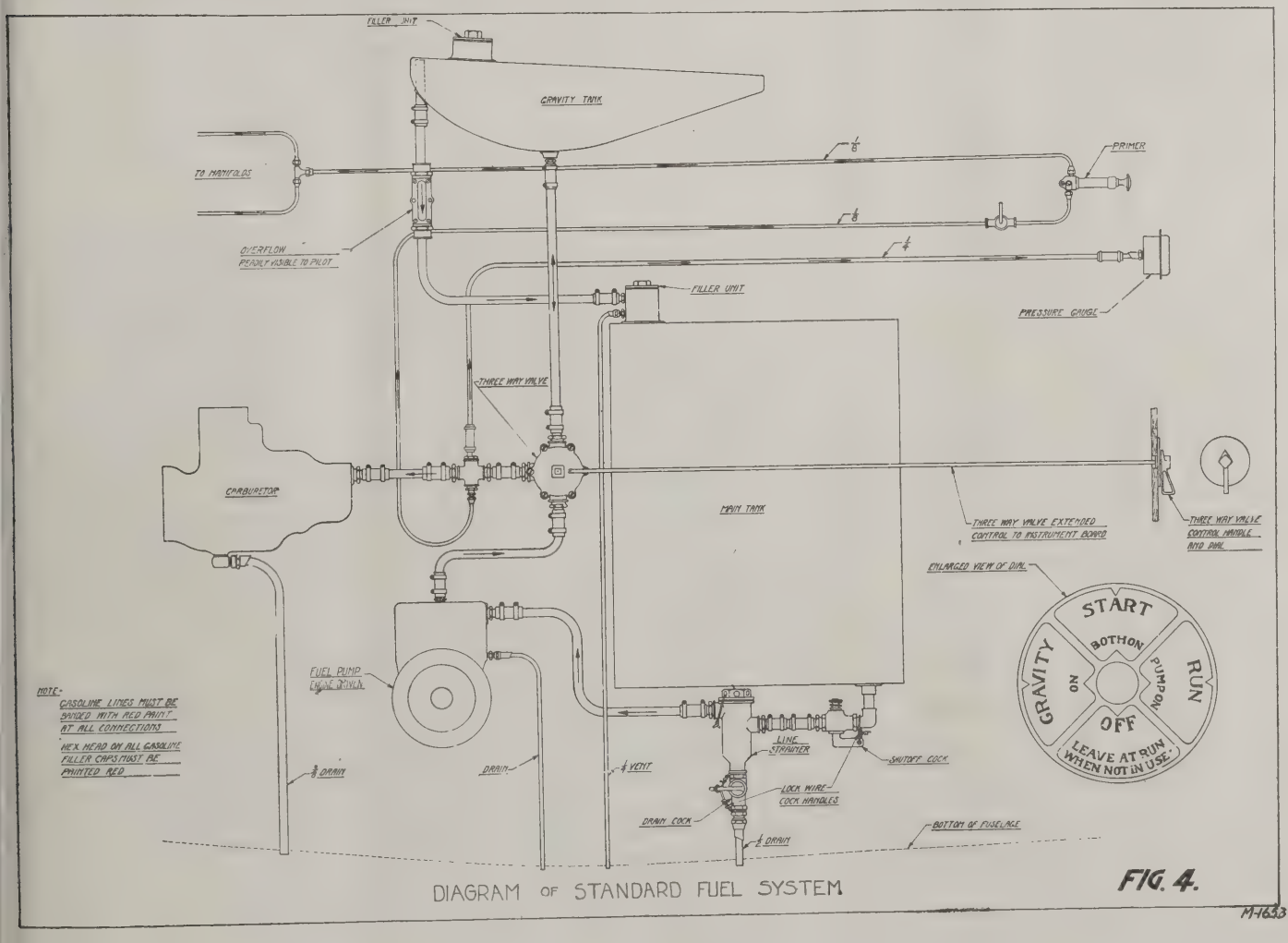
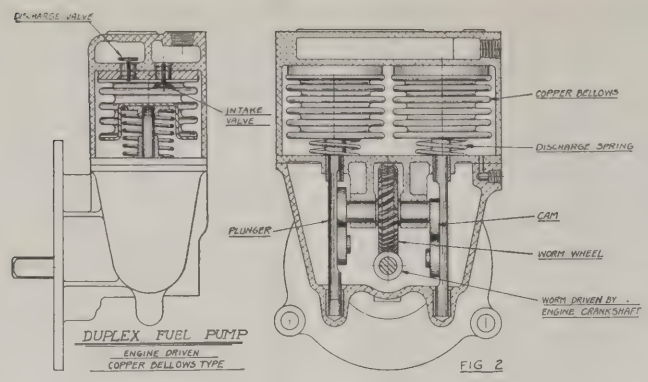


DIAGRAM OF STANDARD FUEL SYSTEM

FIG. 4.

M-1633



2 shows this pump mounted.

The Wright Model "H" pump has a square drive which fits into a special nut which replaces nut (11240) on the end of the magneto drive gear shaft (13127). It is attached to the rear end of the magneto bracket. Figure 3 shows this pump mounted.

Either "in" and either "out" may be used in piping these pumps. The "in" and "out" not used must be plugged. Care must be taken not to get dirt into the valve chamber when this work is done.

The ⅛-inch pipe thread tapped hole about half way down on one side should be piped through the bottom of the fuselage. This acts as a drain in case of gasket leak or other failure, thus reducing fire hazard.

Figure 4 shows a typical piping installation using this type of pump.

Precautions

Study figure 1 and read "Disassembly" carefully before attempting disassembly. Lock all screws with wire in reassembling.

The pump base should be thoroughly cleaned of lubricant, and about one-fifth of a pound of fresh vaseline put in every 300 hours of service.

Do not use rubber for gasket material. "Goodyearite," "Vaporite," "Seigelite," or other strong sheet with flax or asbestos fibre is satisfactory.

In reassembling, before putting on sylphon chamber, line up holes in top sylphon heads and no trouble should be experienced in threading screws into place.

Before assembling, see that valves are clean and working properly.

In reassembling, see that sylphon height from bottom of lower head to top of upper head is 1⅞ inches.

Actuating springs should have a tension of 12¼ pounds, plus or minus ¼ pound, when compressed to 1¼ inches.

Air Service Information Circular, Vol. III, No. 281.

THE TRUTH ABOUT COMMERCIAL AVIATION

THE Society of Automotive Engineers, whose membership is composed of some 5,000 of the foremost engineers and executives connected with the automotive industry, held during the month of December a number of meetings in the principal cities, at which different members of the organization and other competent authorities have given some highly interesting facts concerning the recent progress in commercial aviation.

Contrary to the general belief, it was brought out that America is not behind Europe in the development of aviation, but that it surpasses any other country in the number of miles flown. Regularity of service, it is true, is more marked in Europe, where the government's subsidies are based upon the number of miles flown, but the actual cost of operation here appears to be no higher than abroad.

Asst. Postmaster General Shaughnessy, speaking at Philadelphia, told of the progress recently made in the air mail service, and stated that during the third quarter of this year 391,000 miles were flown and that over 10,000,000 letters were carried; 97 per cent. of the scheduled trips were completed on time and no injuries were suffered on regular trips during this entire period. The cost of operation, which was $8.00 per ton-mile in 1920, was reduced to $6.00 per ton-mile in 1921, and with improved design of machine now being put into use, will be reduced to $2.60 per ton-mile.

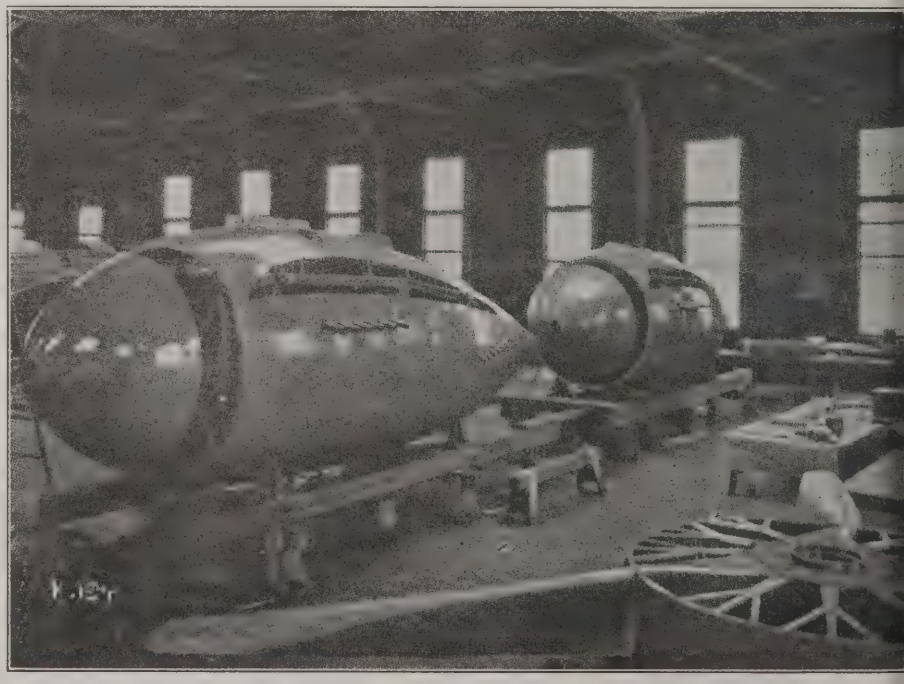
C. F. Redden, general manager of the Aeromarine Airways, at a meeting in New York spoke convincingly of the fact that commercial aviation has actually arrived and stated that the problem is now largely one of inducing people to take advantage of the opportunities that are available for commercial flight. Since the cost of operating a large passenger carrying machine is largely independent of the number of persons carried, it is evident that as traffic increases and planes are enabled to fly with approximately full loads, the cost per passenger will decrease.

J. G. Vincent, who flew from Dayton to Indianapolis for the purpose of attending the meeting there and who also spoke at St. Louis, gave a clear analysis of the economic possibilities of the aeroplane for commercial work. He indicated the factors now impeding the growth of aerial transportaton and suggested ways of overcoming these obstacles.

Glenn L. Martin in Chicago stated that the comparatively high cost of speedy transportation by air is no more of a bar to its use than is the higher cost of taxicab transportation over that of the street cars.

Other speakers touched upon various different phases of the situation, such as landing fields, radio and meteorological service, ground organizations, improvements in design and the relation of civil aviation to national defense. A number of speakers supported the Wadsworth bill for the federal control of civil aviation.

The remarkable attendance at all of the meetings was evidence of the popular desire for an authoritative progress report on flying as a business proposition.



View in the Gallaudet Aircraft Factory showing two of the Gallaudet Nacelles Housing the Gallaudet Multiple Drive

THE CHOICE OF WING SECTIONS FOR AEROPLANES

EDWARD P. WARNER

Secretary, Committee on Aerodynamics National Advisory Committee for Aeronautics.

(Technical Note Natural History Committee for AERIAL AGE*)*

(Continued from page 420)

Treating the same illustrative problem as before, tabulating the various quantities involved for each section, a new order of merit is obtained.

Section		$C_{L_{max.}}$	$\sqrt{C_{L_{max}}}$	$\sqrt[6]{C_{L_{max.}}}$
U.S.A.	5	1.290	1.133	1.042
	15	1.184	1.088	1.028
	16	.992	.996	.999
	17	1.082	1.040	1.013
	21	.913	.955	.985
	27	1.411	1.188	1.059
U.S.A.T.S.	5	1.512	1.230	1.072
	10	1.732	1.317	1.096
	13	1.294	1.138	1.044
R.A.F.	6	1.200	1.095	1.031
	15	1.109	1.053	1.017
Göttingen	387	1.640	1.280	1.086

Section		$\frac{42{,}800\ P^2}{\sqrt{C_{L_{max.}}}\ V^2_{min.}\ W^2}$	L/D	L/D × $\sqrt[6]{C_{L_{max.}}}$
U.S.A.	5	.100	6.60	6.87
	15	.104	7.37	7.58
	16	.114	7.67	7.66
	17	.109	8.01	8.11
	21	.119	7.73	7.61
	27	.095	6.93	7.34
U.S.A.T.S.	5	.092	6.65	7.13
	10	.086	6.14	6.73
	13	.100	6.34	6.62
R.A.F.	6	.104	6.87	7.08
	15	.108	7.60	7.73
Göttingen ..	387	.089	6.66	7.23

The relative merit of the sections as shown by this table is almost identical with that determined from the analysis with changes of weight ignored. In all practical problems the simpler type of treatment, by which the relative efficiencies are read off directly from the L/D chart, will suffice.

This case, like the one in which the weight is assumed constant, can readily be treated on the assumption of a fixed parasite resistance coefficient in place of that of a fixed ratio of parasite resistance to wing drag. As has just been shown, however, the difference between the results with the two assumptions is so small that it would hardly be worth carrying through another example.

These methods of comparison, while accurate, are rather complex, and it is worth while seeking a somewhat simpler device. Such a device can readily be obtained for the case of landing speed and constant weight. Writing the equation,

$$D = \frac{W}{L/D} = \frac{W}{\frac{C_{L_{max.}}}{C_D} \times \frac{C_L}{C_{L_{max.}}}} = \frac{W}{\frac{C_{L_{max.}}}{C_D}} \times \left(\frac{V}{V_{min.}}\right)^2$$

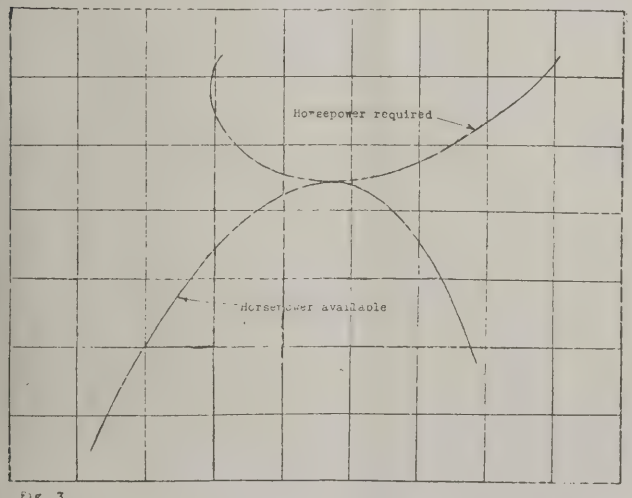


Fig. 3

Since all aeroplanes having a speed ratio of from 1.9 to 2.8 (all, in short, except a few with an exceptionally high power loading) fly when at maximum speed at an angle of attack close to that of minimum drag, and since the drag coefficient curve is very flat in the neighborhood of its minimum ordinate, little error will result from inserting $C_{D_{min.}}$ for C_D in the above equation. In general, therefore, the wing best suited for maximum speed is that for which the value of $\frac{C_{L_{max.}}}{C_{D_{min.}}}$ is highest. The value of this ratio has been tabulated below for a few wing sections, all tested at the Massachusetts Institute of Technology, wind tunnel under the same conditions.

Aerofoil		$\frac{C_{L_{max.}}}{C_{D_{min.}}}$
U.S.A.	5	44.9
	15	53.0
	16	52.9
	17	60.4
	21	52.7
	27	50.7
U.S.A.T.S.	5	43.6
	10	36.8
	13	35.0
Göttingen	387	44.5
R.A.F.	6	42.0
	15	57.8

C. Choice of Section for Maximum Speed Range Ratio

Writing, as in (b), the equations of maximum and minimum speed, with appropriate allowance for dependence of weight on area:

$$C'_D\ V^3_{max.} = \frac{220\ P}{\frac{\rho}{2} S}$$

$$V_{max.} = \sqrt[6]{\frac{48{,}400\ P^2}{\left(\frac{\rho}{2}\right)^2 S^2\ C'^4_D}}$$

$$W = C_{L_{max.}} \frac{\rho}{2} S\ V^2_{min.}$$

$$V_{min.} = \sqrt[6]{\frac{W^3}{C^2_{L_{max.}}\ S^3 \left(\frac{\rho}{2}\right)^3}}$$

$$\frac{V_{max.}}{V_{min.}} = \frac{\sqrt[6]{48{,}400\ P^2\ S\ C^3_{L_{max.}} \frac{\rho}{2}}}{W^3\ C'^2_D} = \sqrt[6]{\frac{57.5\ P^2\ S\ C^3_{L_{max.}}}{W^3\ C'^2_D}}$$

Substituting $K\ S^{1/6}$ for W,

$$\frac{V_{max.}}{V_{min.}} = \sqrt[6]{\frac{57.5\ P^2\ C^{3^{12}}_{L_{max.}}}{K^3\ C'^2_D}} \times \sqrt{S}$$

It therefore appears, since S is a variable quite independent of all the rest, that speed range ratio can be increased without limit by a sufficient increase in wing area. The gain is, however, very slow, an increase of 50% in area raising the ratio by only 4%. The comparison of wing sections can be made most reasonably by assuming a constant area. If this be done, the best section is that giving the highest value of $\frac{C^3_{L_{max.}}}{C'^2_D}$, where

C'_D is the drag coefficient at an angle so chosen that

$$\sqrt[12]{\frac{57.5\ P^2\ C_{L^5max.}}{K^3\ C'_D{}^3}} \times \sqrt[12]{S} = \sqrt[4]{\frac{C_{L max.}}{C'_L}}$$

$$\frac{\sqrt[3]{C'_D}}{\sqrt{C'_L}} \sqrt[6]{\frac{57.5\ P^2}{K^3}} \times \sqrt[12]{S}$$

$$\frac{C'_D{}^2}{C'_L{}^3} = \frac{57.5\ P^2\ S^{1/2}}{K^3}$$

Since S is assumed to have been initially fixed, both S and W can be considered as constants, and

$$K^3 = \frac{W^3}{\sqrt{S}}$$

$$\therefore \frac{C'_D{}^2}{C'_L{}^3} = \frac{57.5\ P^2\ S}{W^3}$$

the same condition as was initially found to define maximum horizontal speed in case (a). The original plot of L/D against $\frac{C_D{}^2}{C_L{}^3}$ can therefore be used, the angle of attack which gives the appropriate value of $\frac{C'_D{}^2}{C'_L{}^3}$ being determined and the cube of the maximum lift coefficient of the wing under consideration being divided by the square of the drag coefficient at the angle thus determined. The best section is the one showing the largest value for this quantity.

Returning to the same problem as before,

$$\frac{57.5\ P^2\ S}{W^3} = .0795$$

Section	$C_{L max.}$	$(L/)^1$	C'_D	$\frac{C'_{L max.}{}^3}{C'_D{}^2}$
U.S.A. 5	1.290	6.59	.0443	1616
15	1.184	7.28	.0325	1306
16	.992	7.38	.0314	792
17	1.082	7.81	.0263	1236
21	.913	7.34	.0318	616
27	1.411	7.03	.0365	2039
U.S.A.T.S. 5	1,512	6.81	.0400	2219
10	1.732	6.46	.0467	2858
13	1.294	6.34	.0494	1121
R.A.F. 6	1.200	6.78	.0404	1090
15	1.109	7.40	.0310	1133
Göttingen 387	1.640	6.93	.0380	2956

The advantage in this comparison clearly rests very strongly with the thick, high-lift sections.

If the assumption of constant parasite resistance is made, the problem becomes to find the wing with the highest value of $\frac{C'_{L max.}}{(C'_D + .04)^2}$ where C'_D is determined by the condition:

$$\frac{(C'_D + .04)^2}{C'_L{}^3} = \frac{230\ P^2\ S}{W^3}$$

$(C'_D + .04)^2$

This solution would show the thick wings, all of which have high minimum drag coefficients, in an even more favorable light than the preceding one.

D. Choice of Section for Maximum Rate of Climb

Although the air speed for best climb is not in general identical with that for minimum power required, nevertheless the two are close enough together so that the problem of securing a maximum rate of climb reduces itself essentially, provided that the weight remains constant, to the problem of cutting down to as low a value as possible the minimum power required for horizontal flight.

The rate of climb can be expressed by the equation:

$$C = \frac{\eta P}{W} - \frac{(C_D\ S + C_R)\ \frac{\rho}{2}\ V^3}{W}$$

where c is the rate of climb.

If it be assumed that the parasite resistance is 40% of the total resistance under conditions of best climb and that the propeller efficiency is 75%, the equation becomes:

$$C = \frac{412\ P}{W} - \frac{5/3\ C_D\ S\ V^3}{C_L\ S\ V^2} = \frac{412\ P}{W} - \frac{5\ V}{3\ L/D}$$

In this case, as in that of maximum speed, the area may be treated either as a constant or as a variable. If S be taken as fixed at the same value for all wings W is also a constant, and the problem becomes simply one of making $\frac{L/D}{V}$ as large as possible. With W and S constant,

$$V = \sqrt{\frac{W}{\frac{\rho}{2} S}} \times \sqrt{\frac{1}{C_L}}$$

$$\frac{L/D}{V} \propto \frac{L}{D} \times \sqrt{L_C}$$

and the maximum value of this function can be found by plotting it directly against angle.

For a more accurate analysis the equation given above is not quite satisfactory, as it leads to emphasizing the properties which the wing possesses at an angle smaller than that of best climb. It is better, instead of taking the parasite resistance coefficient as a certain proportion of the wing drag coefficient, to take it as an additive constant. The average value of this constant as already noted, is .04 A. Therefore

$$C = \frac{412\ P}{W} - \frac{(C_D + .04)\ \frac{\rho}{2} S\ V^3}{C_L \frac{\rho}{2} S\ V^2} = \frac{412\ P}{W} - \frac{(C_D + .04)\ V}{C_L}$$

If the weight and area are constant, therefore, the best wing for climb is that which has the largest maximum value of $\frac{C_L{}^{3/2}}{C_D + .04}$, a function the maximum value of which for each section must be found by computing it directly for a few angles and plotting against angle.

If the area is allowed to vary without restriction, the weight being assumed to depend on area in the same manner as heretofore, the equation becomes:

$$C = \frac{412\ P}{K S^{1/6}} - \frac{(C_D + .04) \sqrt{\frac{K\ S^{1/6}}{S}} \sqrt{\frac{1}{\rho/2\ C_L}}}{C_L} =$$

$$\frac{412\ P}{K\ S^{1/6}} - \frac{(C_D + .04) \sqrt{K}}{S^{5/12}\ C_L{}^{3/2}\ (\frac{\rho}{2})^{1/2}}$$

$$\frac{dC}{dS} = -\frac{69\ P}{K S^{7/6}} + \frac{5\ (C_D + .04) \sqrt{K}}{12\ S^{17/12}\ C_L{}^{3/2}\ (\frac{\rho}{2})^{1/2}}$$

considering C_D and C_L as constants. For maximum climb

$$\frac{69\ P}{K S^{7/6}} = \frac{5\ (C_D + .04) \sqrt{K}}{12\ S^{17/12}\ C_L{}^{3/2}\ (\frac{\rho}{2})^{1/2}}$$

$$\frac{5.61\ P}{K\ S^{7/6}} = \frac{(C_D + .04) \sqrt{K}}{S^{17/12}\ C_L{}^{3/2}}$$

$$\frac{5.61\ P\ S^{1/4}}{K^{3/2}} = \frac{C_D + .04}{C_L{}^{3/2}}$$

Substituting the value just determined for $S^{1/4}$,

$$C = \frac{1}{S^{1/6}} \left[\frac{412\ P}{K} - \frac{(C_D + .04) \sqrt{K}}{C_L{}^{3/2}\ (\frac{\rho}{2})^{1/2}} \times \frac{5.61\ P C_L{}^{3/2}}{K^{3/2}\ (C_D + .04)} \right] =$$

$$\frac{1}{S^{1/6}}\left[\frac{412\ P}{K}-\frac{166\ P}{K}\right]^2=\frac{246\ P}{KS^{4/6}}=\frac{246\ P}{W}$$

$$S^{1/6}=\left[\frac{(C_D+.04)\ KS^{1/6}}{5.61\ P\ C_L^{3/2}}\right]^{2/3}$$

$$C=\frac{246\ P}{K}\left[\frac{5.61\ P\ C_L^{3/2}}{(C_D+.04)\ K^{3/2}}\right]^{2/3}=\frac{777\ P^{5/3}\ C_L}{(C_D+.04)^{2/3}\ K^2}=$$

$$\frac{777\ P^{5/3}}{K^3}\left(\frac{C_L^{3/2}}{C_D+.04}\right)^{2/3}$$

The values of K for a few modern aeroplanes are tabulated below:

	K
D. H. 4	1300
Vought V. E. 7	820
Curtiss JN4D	760
Fokker D7	800
Martin Bomber	3200
Handley-Page (4-engined)	6350
Thomas-Morse MB3	830

As a further basis for comparison, the maximum values of $\frac{C_L^{3/2}}{C_D+.04}$ have been calculated for several good aerofoil sections, all of which have been tested under the same conditions at the Massachusetts Institute of Technology, and are tabulated at the end of this section.

As illustrations, the theoretical best area will be calculated for aeroplanes of the type of the Vought and Martin Bomber, assuming the U. S. A. 15 wing to be used in both cases.

Vought

$$S=\left[\frac{(C_D+.04)\ K^{3/2}}{5.61\ P\ C_L^{3/2}}\right]^4$$

$$\frac{C_D+.04}{C_L^{3/2}}=\frac{1}{8.65}=.116\ \text{(see Table)}.$$

$K=820$

$P=180$

$A=(2.68)^4=51\ \text{ft.}^2$

Martin

$K=3200$

$P=800$

$$A=\left(.116\times\frac{3200\times56.6}{5.61\times800}\right)^4=(4.64)^4=460\ \text{ft.}^2$$

It will be observed that these optimum areas are far below those actually employed, and we conclude that the rate of climb at ground level could be materially improved for most present-day aeroplanes by decreasing the area. This, however, would be very injurious to the ceiling and the rate of climb at high altitudes. If the best area is to be found for rate of climb at 10,000 feet, for example, instead of at sea level, the engine power being reduced by 28% and the power required for flight at a given angle of attack being increased by 18%, the equating to zero of the derivative of the rate of climb gives:

$$.72\times\frac{69\ P}{KS^{7/6}}=\frac{1.18\times5\ (C_D+.04)\sqrt{K}}{12\ S^{17/42}C_L^{3/2}\left(\frac{\rho}{2}\right)^{1/2}}$$

$$\frac{3.42\ P\ S^{1/4}}{K^{3/2}}=\frac{C_D+.04}{C_L^{3/2}}$$

The best area for rate of climb at 10,000 feet is therefore 6.55 times as large as for rate of climb at sea level. This works out at 330 square feet for the Vought, 3030 square feet for the Martin, the first figure slightly larger, the second much larger that the areas actually employed. The optimum area for any given type of aeroplane runs up very rapidly as higher altitudes are considered, approaching infinity as the ceiling is approached.

Whatever altitude may be taken as a basis, however, and whatever may be the type of aeroplane, the aerofoil section which gives the best rate of climb with a free choice of aera is the section which gives the largest maximum value of $\frac{C_L^{3/2}}{C_D+m}$, and .04 is a good average value for m.

It should be remembered, of course, that this discussion has been based on an implicit assumption that the propeller, as well as the wing section, is to be chosen for climb alone. If this were the case, most aeroplanes would climb best at an angle of attack of about 10°, under which conditions $\frac{C_L^{3/2}}{C_D+.04}$ reaches its maximum. In service aeroplanes, however, the propeller is usually designed for best performance in the neighborhood of the maximum horizontal speed, and the propeller efficiency falls off rapidly with decreasing speed of flight. The best climb in actual practice is therefore obtained at an angle of attack of about 6° at sea level in most cases, and the wing performance in terms of power consumed under those conditions is approximated to by the maximum value of $\frac{C_L^{3/2}}{C_D}$, as already noted.

There are, then, two excellent criteria of rate of climb, the maximum value of $\frac{C_L^{3/2}}{C_D+.04}$ and that of $\frac{C_L^{3/2}}{C_D}$. The first is especially suited for judging performance at high altitudes and for use in connection with aeroplanes which have a very small speed range ratio, or which, like some commercial and bombing types, are designed for economy rather than for extreme speed and ceiling and which accordingly employ propellers giving their best efficiency at a speed considerably below the maximum.

To facilitate comparison, both criteria have been tabulated together for a dozen good wing sections.

	$\frac{C_L^{3/2}}{C_D+.04}$	$\frac{C_L^{3/2}}{C_D}$
U.S.A. 5	9.05	13.31
15	8.66	13.13
16	7.75	12.38
17	8.29	12.51
21	7.03	12.26
27	9.05	13.38
U. S. A. T. S. 5	8.85	11.78
10	9.31	12.59
13	8.79	11.92
R. A. F. 6	8.49	12.69
15	8.10	12.06
Göttingen 387	9.21	12.32

If the wing area, instead of being varied at will, is kept constant, it is obvious that maximum climb reduces simply to a question of minimum power consumption, and that the same two criteria hold as in the previous case, with the same general rules governing the choice between them. The numerical relations between the climbing speeds with any particular pair of aerofoils, are, however, very different for the fixed and for the variable area.

The case of best climb for a given landing speed is rather complex to treat, and arises so rarely that discussion is hardly worth while.

E. Choice of Wing Section for Maximum Absolute Ceiling

In this case, as in the last one, it will be assumed that the best possible propeller for the particular characteristic under examination is employed.

It can readily be shown that the best propeller for ceiling is one which causes the curves of power available and power required to meet at the ceiling in such a way that their common tangent is horizontal, as shown in Fig. 3. Furthermore, it appears that if such a propeller is used, the ceiling depends only on the ratio of maximum power available at sea level to minimum power required at sea level.

Since power available is dependent neither on wing characteristics nor on weight, the requirement for maximum ceiling reduces itself to a simple matter of keeping the minimum power required for horizontal flight as small as possible. This condition has already been treated for the case of a fixed wing area, under (D), where it was shown to be roughly true that minimum power is required with the section which gives the largest value of $\frac{C_L^{3/2}}{C_D+.04}$.

It is impossible to find a "best area" for ceiling, as was done for rate of climb, as it is theoretically possible to increase

the ceiling without limit by sufficiently increasing the area. A practical case which does arise frequently, however, is that in which it is desired to obtain maximum ceiling in conjunction with a given maximum speed. In order to secure the same maximum speed on the same type of aeroplane with several different wing sections, the areas must obviously be different. To determine the area for a given maximum speed with each section, the analysis undertaken in the early part of the paper must be carried further.

It has already been shown that

$$\frac{C_D^2}{C_L^3} = \frac{57.5\ P^2\ \sqrt{S}}{K^3}$$

and

$$\frac{L}{D} = \frac{W\ V}{220\ P} = \frac{K\ V\ S^{1/6}}{220\ P}$$

if the weight be assumed proportional to the sixth root of the area. Therefore,

$$\frac{\frac{C_D^2}{C_L^3}}{\left(\frac{C_L}{C_D}\right)^3} = \frac{6110\ (10\ P)^5}{K^6\ V^3}$$

If a value of V be chosen and K be assumed and the power is known it is now possible to solve for

$$\frac{\frac{C_D^2}{C_L^3}}{\left(\frac{C_L}{C_D}\right)^3}$$

and the point at which the prescribed value occurs for any particular section can readily be determined by trial from the curve of $\frac{L}{D}$ against $\frac{C_D^2}{C_L^3}$, dividing the abscissa by the cube of the ordinate. This point being located, the abscissa is multiplied by the square of the ordinate to find the lift coefficient and so the area.

$$\frac{C_D^2}{C_L^3} \times \left(\frac{C_L}{C_D}\right)^2 = \frac{1}{C_L} = \frac{\frac{1}{2} S\ V^2}{W} = \frac{\frac{1}{2} S\ V^2}{K S^{1/6}} = \frac{\frac{1}{2} S^{5/6}\ V^2}{K}$$

$$S = \left[\frac{K}{\frac{\rho}{2} V^2} \times \frac{C_D^2}{C_L^3} \times \left(\frac{L}{D}\right)^3\right]^{6/5}$$

The maximum area permitting of a given maximum speed is thus determined.

The minimum HP required is:

$$P_{min.} = \frac{(C_D + .04)\ \frac{\rho}{2}\ S\ V^3}{550} = \frac{(C_D + .04)\ S\ W^{3/2}\ \frac{\rho}{2}}{550\ S^{3/2}\ C_L^{3/2} \left(\frac{\rho}{2}\right)^{3/2}}$$

$$= \frac{(C_D + .04)\ K^{3/2}}{18.9 C_L^{3/2}\ S^{1/4}}$$

The section giving the best ceiling with a given maximum speed is therefore the one giving the lowest minimum value of $\frac{C_D + .04}{C_L^{3/2}\ S^{1/4}}$, where A is calculated in accordance with the procedure described in the preceding paragraph.

To illustrate the use of this method, another problem will be worked. Given a pursuit aeroplane with a 300 HP engine and K equal to 1000 (the value corresponding to a weight of 2500 lbs. and an area of 240 sq. ft.), the problem is to choose the wing section giving the highest ceiling in conjunction with an air speed at sea level of 140 m.p.h., or 205 ft. per sec. This problem, like the preceding ones, can best be solved by systematic tabulation.

$$\frac{1940\ (10\ P)^5}{K^6\ V^3} = \frac{6110\ (3000)^5}{1000^6 \times 205^3} = .000172$$

Section		$\frac{C_D^2}{C_L^3}$	$\frac{L}{D}$	A	Min. $\frac{C_D + .04}{C_L^{3/2}\ S^{1/4}}$	Rank
U.S.A.	5	.0722	7.53	198	.0294.....	4
	15	.0840	7.93	268	.0285.....	2
	16	.0924	8.18	325	.0305	
	17	.0962	8.21	344	.0280.....	1
	21	.0957	8.20	340	.0331	
	27	.0743	7.61	210	.0290.....	3
U.S.A.T.S.	5	.0676	7.37	174	.0311	
	10	.0595	7.03	133	.0315	
	13	.0664	7.31	166	.0317	
R.A.F.	6	.0750	7.65	215	.0308	
	15	.0891	8.09	303	.0296.....	5
Göttingen	387	.0674	7.34	171	.0299.....	6

The thin sections thus appear to have some advantage over the best of the thicker ones, but, as already pointed out, this method hardly gives due weight to the great structural advantages of the thick section. A somewhat fairer comparison between sections of widely different thickness can be made by assuming a constant resistance coefficient of .0001 throughout. It is obvious from what has gone before that if this be done the limiting condition at maximum speed becomes:

$$\frac{62{,}100\ (10\ P)^5}{K^6\ V^3} = \frac{(C_D + .04)^2}{\left(\frac{C_L^3}{C_D + .04}\right)^3}$$

and the area equation is:

$$S = \left[\frac{K}{V^2} \times \frac{(C_D + .04)^2}{C_L^3} \times \left(\frac{C_L}{C_D + .04}\right)^2\right]^{6/5}$$

while the final criterion of merit is the minimum value of

$$\frac{C_D + .04}{C_L^{3/2}\ S^{1/4}}, \text{ as before}$$

The illustrative problem may now be attacked anew by this method.

$$\frac{62{,}100\ (10\ P)^5}{K^6\ V^3} = .0055.$$

Section		$\frac{(C_D + .04)^2}{C_L^3}$	$\frac{C_L}{C_D + .04}$	A	Min. $\frac{C_D + .04}{C_L^{3/2}\ S^{1/4}}$	
U.S.A.	5	.281	3.71	185	.0300.....	2
	15	.302	3.79	212	.0303.....	4
	16	.308	3.81	220	.0336	
	17	.304	3.80	215	.0315	
	21	.302	3.79	213	.0372	
	27	.286	3.72	190	.0298.....	1
U.S.A.T.S.	5	.275	3.68	175	.0311.....	6
	10	.250	3.56	145	.0310.....	5
	13	.266	3.64	166	.0317	
R.A.F.	6	.286	3.72	190	.0318	
	15	.305	3.81	217	.0321	
Göttingen	387	.268	3.64	167	.0301.....	3

The order of merit of the best sections is somewhat different from that determined by the first method, although four of the sections appear among the best six in both tabulations. Some judgment must be used in deciding which table to employ, the choice depending on the nature of the structure and the extent to which parasite resistance can be reduced when the wing section is thickened. Furthermore, thin sections with high minimum drag coefficients, such as the U.S.A. 5, should be viewed with suspicion when they give very much better relative results by the second method than by the first, as the proportional reduction of total parasite resistance in changing from the U.S.A. 15 to the U.S.A. 5, for example, would not be as great as the reduction of area.

The type of problem just solved is the most important one possible in a high altitude pursuit aeroplane. It appears clear that among the twelve sections considered, the best suited for use on such an aeroplane from the standpoint of performance alone is the U.S.A. 27, with the Göttingen 387, U.S.A. 15, and U.S.A. 5 following in that order.

F. Choice of Wing Section for Maximum Radius of Action.

Again supposing the propeller to be working at its maximum efficiency, problem of radius of action is one merely of minimum resistance, or, in other words, of maximum L/D of the aeroplane. Since for a fixed efficiency of propeller and power plant, a definite proportion of the heat units in the fuel reappear as useful work of propulsion, and since this useful work is equal to the product of resistance by distance flown, the distance possible with a given weight of fuel is obviously inversely proportional to the resistance. (*Concluded on page* 451)

NAVAL and MILITARY AERONAUTICS

Bolling Memorial Unveiled

Greenwich, Conn.—The statue of Col. Raynal Cawthorne Bolling, the first high ranking American officer killed during the World War, was unveiled January 7th on the Havemeyer School grounds in the presence of several hundred persons, including distinguished men in public life. The statue was unveiled by Raynal C. Bolling, Jr., Col. Bolling's son.

The statue is seven feet high. It is the work of Edward Clark Potter of Greenwich. The bronze work on the figure was done by Tiffany & Co. The statue was first placed in position last October.

After the unveiling exercises were held in the Havemeyer Auditorium, Gen. Pershing, an intimate friend of Col. Bolling's, was invited to give an address, but was unable to attend. Gen. Mason M. Patrick, head of the United States Air Service; Gov. Lake of Connecticut, and Dr. George E. Vincent, head of the Rockefeller Foundation, were the speakers.

Gen. Patrick, associated with Col. Bolling during the war, paid a high tribute to Col. Bolling's soldierly devotion to duty, his work in the Air Service, and said the Government's largest training school for fliers had been the direct result of his labors in the development of the air wing of the army.

Gov. Lake's address was concerned with the great influence for good such a life as Col. Bolling's had upon the nation, and Dr. Vincent, for years Bolling's neighbor at Greenwich, told of the soldier's beneficial influence on the community.

Col. Bolling was sent to France soon after the United States declared war to inspect aeroplanes which were to be bought by the American Government. In the discharge of this duty he was killed by a German bullet at Amiens, March 26, 1918. He was decorated with the Distinguished Service Medal. He was general solicitor of the law department of the New York office of the United States Steel Corporation and a member of several clubs in and near New York.

New Operations Office at Post Field

A new operations office, located on the flying field, has just been completed at Post Field, Fort Sill, Okla., as the first step in an improvement program that promises to make this station one of the best appearing fields in the country. In addition to housing the office and equipment of the Operations Department, a lounge for pilots is provided. Comfortable seats, pictures, and flying and other publications make this an attractive gathering place. Work has already begun on an ornamental gateway to the field. The entrance is being widened and will be marked by two large stone pylons, each surmounted by an electric light. The painting of buildings is also under way.

Type D Airship Arrives at Ross Field

The long hoped for "D" type airship arrived at Ross Field on December 6th and is now under the care of Lieut. Shoptaw, who will supervise the preparation of the airship for flights. Some work must be done to realign the car and put it in first class shape. As soon as the new steel hangars are completed the ship will be inflated and put in the air. The concrete standards are all laid and set, everything being ready for the erection of the steel structure, which is expected to arrive shortly from the East.

Test of Flotation Gear on a De Haviland Plane

A test of the merits of a flotation gear installed on a DeHaviland 4B plane under the direction of 1st Lieut. F. D. Hackett, Air Service, engineering officer at Crissy Field, Presidio of San Francisco, Calif., was made at that station on the afternoon of December 9th. The plane was ready for the test at the scheduled time, Photographic Section No. 15 being present for the purpose of securing suitable pictures of the event, also many interested observers. Major George H. Brett, commanding officer of Crissy Field, in company with Major H. H. Arnold, 9th Corps Area Air Officer, gave the signal, and Lieut. Hackett as pilot, with Master Sergeant Alfred Bernhard as passenger, took off amid the well wishes for a successful trial. After circling the field at an altitude of about 1,000 feet, Lieut. Hackett pulled the throttle and nosed her down, while movie men present cranked their cameras. Prior to the take off, a boat manned by Crissy field men put out for the bay and stayed by for the landing of the plane. Within an hour and a half after the successful landing, the Crissy field men had the plane back in the hangar and were preparing it for another like flight. Much was gained from this flight, as it certainly demonstrated that the floatation gear will well serve its purpose and should be installed in all ships flying out of Crissy Field which work with the Coast Artillery, as their missions always carry them well outside of a safe gliding distance to land.

Two Naval Aviators Killed at Pensacola

Pensacola.—Lieuts. Frank Sloman, of Oakland, Cal., and Elton C. Herseman, of Weston, W. Va., aviators from the naval air station here, were killed Jan. 3 when their aeroplane went into a nose dive at an altitude of 1,000 feet and crashed off Fort Barrancas wharf.

Sloman was acting as instructor and Herseman was making his first flight at the station. The former, who was 28, is survived by a widow and ten-months-old baby. Herseman is survived by his father, W. S. Herseman, of Weston, W. Va.

Agree on Aeroplane Carriers

At the Naval Committee session of the Disarmament Conference, agreement was reached on the ratio of aeroplane carriers. The ratio of 5-5-3-2-2 was adopted for the five powers, which means 135,000 tons for the United States, 135,000 tons for Great Britain, 81,000 tons for Japan, 60,000 tons for France and 60,000 tons for Italy.

Accident at Arcadia

Arcadia, Fla.—Lieutenants Samuel H. Davis, of San Antonio, Texas, and William G. Sinclair, of Augusta, Ark., were instantly killed Dec. 28 when their aeroplane went into a tail spin about five miles from here.

The officers were attempting to land and were but a few feet from the ground, spectators said, when the fatal crash occurred. Both bodies were badly burned.

The Lieutenants were stationed at the Carlstrom Army Aviation Field.

Port Newark as Aerial Terminal

Definite proposals for the construction in Port Newark of a great airline terminal which may send passenger dirigibles to Europe are to be made in the near future.

Tentative proposals for the erection of a mammoth air depot and aircraft manufacturing center have already been made to the city officials of Newark and City Commissioner Raymond now has these under advisement. According to the plans, which are yet only in nebulous form, it is proposed not only to establish a dirigible line to take passengers from here to European ports and back, but also for air transportation to various parts of this country.

The man most interested, it is said, in the development of this ambitious plan is Paul Witteman, who is well known as an aeroplane expert, having designed a 'plane especially for European flights. Prominent New York financiers are said to be associated with him in the carrying out of the project. They selected Newark, it is stated, after looking over a great many sites, because it affords excellent facilities for the transfer of passengers and freight. Mr. Witteman made a special visit to Washington to confer with government experts about the project.

Chief Engineer James W. Costello, of the department of streets and public improvements of Newark, said that an indefinite proposal to build the air terminal had been made to the city, but that a conference to take up the matter more fully would be held within the next few days.

Mr. Witteman, it is stated, has notified Commissioner Raymond that the proposed airline plant would cover about 330 acres on the water front.

The service between here and Europe, it is declared, would be for passengers at first, but it was also said that not only passengers but freight would be handled in the airlines to points in this country.

FOREIGN NEWS

Fokkers in Spain

The Spanish Air Traffic Company of Madrid has bought two Fokker aeroplanes of the latest type. These will be put into regular service on an air line between Sevilla, Spain, and El Araish (Larache), Morocco. The distance between these points is 170 miles and includes the crossing of the Strait of Gibraltar. This line, which also carries Spanish mails, was recently opened with much ceremony, including a blessing of the machines by the Bishop of Sevilla.

Paris Aerial Police

Aerial police are at last an accomplished fact—on paper at any rate. Headquarters has just been established at Le Bourget, the aviation ground outside of Paris, whence mails and passengers are forwarded daily to most European capitals. It will have the same personnel as other police stations with the addition that all members will be certified flyers.

Their duties will include regulating air traffic and ultimately to be ready for chasing crooks who leave the city in automobiles. One of the duties at the beginning will be the taking of aerial photographs every day of various streets and boulevards in Paris during the crowded hours to help efforts to solve the traffic problem.

The police authorities insist that the photographic assignment is only temporary, as the real purpose of the new organization will be an actual air police force, as it is now authoritatively considered that in the next few years the air traffic will be large enough to require controlling in passing over the city.

British Speed Record

Over the speed course at Martlesham, England, on December 19th Mr. J. H. James established a British record by flying at an average speed of 196.4 m.p.h. in the Mars I, a product of the Gloucestershire Aircraft Company. The previous British speed record was held by James's friend and partner, Mr. Tait-Cox, flying a British Nieuport "Goshawk," whose average speed was 166.5 m.p.h. Both machines were designed by Mr. H. P. Folland, now chief engineer and designer of the Gloucestershire Aircraft Company of Cheltenham.

Over the flying kilometer James managed to beat the previous world's speed record, held by Sadi Lecointe with a speed of 206 m.p.h., by flying at the tremendous speed of 212 m.p.h. The report of the observers still has to be considered by the Royal Aero Club, and it will probably be some little time before the flight is homologated as a world's record. In the meantime we congratulate the Gloucestershire Aircraft Company, Mr. Folland and Mr. James on their wonderful achievement, as well as Messrs. Napiers, who have thus added another victory to the many already won by their famous "Lion" engine. It is a matter of the greatest importance to the prestige of British aviation that such a splendid performance should have been put up by an all-British machine, and it cannot fail to be of benefit to the aviation industry generally, which thus owes a debt of gratitude to the Gloucestershire Aircraft Company for spending the money on producing such a wonderful machine.

French Government and Aerial Budget

Last week the votes for the Air Budget were passed by the French Chamber, the chief items being subsidies, 46,389,000 frs.; aerodromes, 36,690,000 frs.; reserve raining, 3,345,000 frs.; specific work and expenses, 86,405,000 frs. Curiously the Chamber of Deputies so far has not renewed the credits for the Air Attachés in London, Washington, Rome and Peking.

Cairo and Baghdad Air Mail

There is a steady growth in the use of the Cairo-Baghdad air mail service by the public. On October 13th, last, the mail only contained 57 letters. On November 17th the number was 172. On December 1st there were 354 letters. The average time of transmission by ordinary mail from London is 27 days. The air mails dispatched from London during the past two months have reached Baghdad on the average in 12 days, and on three occasions out of five in 10 days or less.

Prize Court Award to Air Pilots

In the Prize Court on December 13th a bounty of £350 was awarded by the President for the destruction of the Turkish destroyer "Yardigar-I-Milet" by the British aeroplane "3124." According to the affidavit of Flight-Commander McClelland, on July 9, 1917, he was on board the aeroplane, which was making a raid on the "Goeben" at Constantinople. He was accompanied by Flight-Commander K. S. Savory, D.S.O., Royal Air Force, the senior officer on board, who is now in West Africa, and Lieut. P. T. Rawlings, Royal Naval Volunteer Reserve. From a height of 800 feet they dropped bombs on enemy submarines and destroyers lying close to the harbor wall. As a result, the Turkish destroyer in question was sunk and destroyed. Seventy persons were believed to be on board.

The British Air Conference

The success which attended the first Air Conference which was held in London last year has led to the decision to hold a second conference at the Guildhall in February next, under the auspices of the Air Ministry. At the last Conference service questions occupied a good deal of attention, but it has been decided that the February gathering will be concerned mainly with the development of commercial aerial transport. All aspects of this question will be discussed, and it is an advantage that Lord Weir has agreed to preside over the technical sessions. Invitations to the Conference are being issued to all those interested in the development of air transport, and arrangements are being made for demonstrations by aircraft and for a visit to the Croydon aerodrome for an inspection of as many types of machines as can be gotten together for exhibition purposes.

When the giant air liner, "City of London," recently left the London Air Station for Paris, a complete aeroplane engine was among the cargo carried.

The French in Portugal

The French company, Transaerienne de Tourisme et Messageries, is making overtures to the Portuguese Government for valuable concessions in Portugal and the islands and also in Portuguese Africa. American Minister Thomas H. Birch states that the company proposes a mail and passenger service for Lisbon, Paris being the starting point. Free transportation of Portuguese mail and the relinquishment of air material to Portugal in case of war are some of the inducements offered by the company.

British Guiana Air Mail

The air mail service, maintained with the assistance of the French Government up the Marowyne River, which is the boundary between French and Dutch Guiana, has been carried on with considerable difficulty, according to reports received from travelers. It is said that the engines are much affected by the moist climate, and that the variable depth of rivers renders a landing on their surface very dangerous because of concealed rocks which are often but a few inches below the surface of the water. This latter difficulty is intensified by the fact that the water is very often covered with mist, which prevents careful observation before landing.

The Bermuda and West Atlantic Aviation Company has proposed to the Government of British Guiana to make a demonstration and survey for aerial transportation—an offer probably now accepted.

Swedish Service Suspended

The bi-weekly air mail service between Stockholm and Reval, run by the Svenska Lufttrafik Aktiebolaget during the months of July, August and September, was suspended on October 1st. The American Minister, Ira N. Morris, at Stockholm, reports that from a technical point of view the service was very successful, but the infrequency of passengers made it a nonpaying enterprise.

The Postmaster General paid a subsidy for the carrying of mail, but this was not large enough to cover even mere working expenses. Of 21 round trips promised, 19 were carried out. The distance was covered in 2 hours and 20 minutes, on an average, while the steamers take 24 hours. Only 21 passengers were carried altogether, and 800 kilos of mail were transported from Stockholm to Reval.

This service has shown that aerial transportation over the Baltic is not only practicable but is likely to fill a real need when Russia again revives.

Argentine Progress

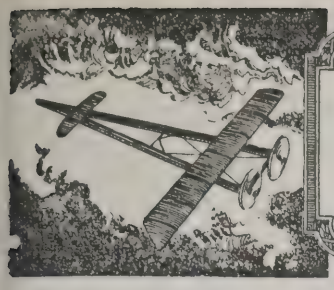
Another indication of the success which is attending the efforts of Colonel Mosconi, Chief of the Army Aviation Service, and of the Argentine Patriotic League and the Aero Club of Argentina in arousing enthusiasm in aviation matters, is the presentation of a Bristol 300-h.p. Hispano Suiza to the Military aviation school at El Palomar by the city of Avellaneda. There seems to be but little doubt that the precise and practical plans of Colonel Mosconi for air routes, landing places, military-civil air station, etc., and the calls on the Provincial governments and cities, and on wealthy citizens for cooperation, are bearing fruit.

An Imperial Airship Service

A good deal has appeared in the daily newspapers recently on the subject of the projected—we call it projected, though suggested would probably be the better term—Imperial airship service. If we were to take seriously all we have read during the past week or ten days, we should begin to think that we are really on the eve of seeing such a service actually in being. But when we come to dissect all that has been said and written, we really cannot see that we have travelled much farther along the road to the consummation of what is the desire of all who have the future of commercial aviation at heart. Let us see to what it all amounts.

At the Imperial Conference of Dominion Prime Minsters it was suggested that an airship service for linking up the Empire should be established. Estimates were submitted which showed that an outlay of about £1,339,000 would be necessary to carry out an experimental service over a period of two years. Later it was thought that it might be done at a cost of a million pounds, and the proposal was put forward that of this the Mother Country should contribute £325,000, Australia and India £250,000 each, Africa £100,000, and New Zealand £75,000. Up to the present the only concrete offer is that of Australia, but it is said that contingent upon the other contributions being forthcoming a financial group is willing to find a further sum of 2½ millions to start a regular service to Egypt, South Africa, India, Australia and New Zealand, such service —which is to be fortnightly—not to be started until the expiration of a two years' experimental period. There seems to be a further contingent stipulation that the British and Dominion Governments must subsidise the service to the extent of £500,000 annually for a term of years. This subsidy, it is proposed, should be provided as to £250,000 by Great Britain and a further equal sum by the Dominions. Mr. Ashbolt, the Agent-General for Tasmania, who has worked hard and unceasingly in favor of the scheme, says that if all these conditions are fulfilled he can get all the money he wants for the service. He is optimistic enough to think that this country will be willing to find any reasonable balance of the amount required to complete the initial £1,000,000 after definite replies have been received from the Dominion Governments.

Well, it may be so, but we confess that when we regard the past and present policy of the Government towards commercial aviation, whether concerning aeroplane or airship, we are not encouraged to hope too much. Naturally, we hope as sincerely as any that the British Government will agree to find any reasonable sum of money to assist in opening up a service which cannot but be of inestimable value to Empire communications, but whether the hope has any justification in fact we frankly do not know. At any rate, it is cheering to know that the scheme for an Empire airship service is not as dead as we had supposed it to be, though we do think that those who have been telling us that the service is likely to be inaugurated with the British airships which are at present "rotting in their sheds" are unduly sanguine. It is certain that the rotting process has not gone too far to be retrieved. Or that the dispersal of *personnel* and stores has not progressed to a point at which it would be true to say that there remains now no nucleus even of a practical service. We should really like to hear from the Air Ministry on this particular point.—*Flight.*



ELEMENTARY AERONAUTICS and MODEL NOTES



The General Design of Model Aeroplanes

By Ellis C. Cook.

Types of Models

PRACTICALLY all model aeroplanes come within two classifications:—

1. The type commonly called the "Flying Stick," of which the model may be either a tractor or a pusher, and have either one or two propellers. This type of model may be further subdivided into three groups:

A. Hand launched
B. Rise-off-ground (Risers)
C. Rise-off-water (Hydros)

2. The "Scale" model fashioned after some successful motor-driven aeroplane. In this class would also be the "Fuselage" models with no large sized prototype. Since all of this class of models have landing gears, there would be no type classification for hand-launched machines, so there would remain only the two groups:

A. Rise-off-ground
B. Rise-off-water

These subdivisions may be further amplified with the distinction between rubber and power-driven machines, monoplanes and biplanes, single or double propellers, or many other variables. My article will be confined to the rubber-driven type and especially to the "Flying Stick" type.

Purposes

The purposes for which the model is designed and built usually come under the following heads:

A. Duration of flight
B. Distance of flight
C. Quality of flight
D. Altitude attained
E. Quick climbing
F. Workmanship

These heads are arranged approximately in their order of importance in the minds of the average model builder. Of course there may be a model built with nothing else in view except accurate construction, but I am considering only the flying models. All of the above qualities are of importance in the better class of models—the ones which are the record holders—and it must not be assumed that good duration or distance may be obtained with a model which behaves badly in the air or which habitually flies but a few feet from the ground.

I propose to go into as much detail as space allows, into the practices of the Illinois Model Aero Club during the past five or six years, in building models which at present stand out as foremost in the world.

Duration of Flight

For the first year or two of this club's existence, all meets centered upon distance flown and duration was but incidental. At present, and for some time past, duration has been the chief quality for which the builder has designed his machine.

Some years ago, while attempting to improve my machines from a duration standpoint, I evolved an empirical formula for the duration of flight with rubber power. It is:

$$\text{Duration (seconds)} = \frac{K \times (\text{weight of rubber}) \times (\text{glide})}{(\text{weight of model}) \times (\text{speed})}$$

Where "Glide" is expressed as, say 6 for a 6:1 ratio. The weights must all be expressed in ounces and the speed in feet per second. The glide might better be called the resistance factor for it is the ratio between the weight and the resistance. The constant K was found by a comparison of several different models, to be approximately 800 for twin propeller pushers. For the tractor type I would expect it to be less on account of the added resistance due to the slipstream. I have calculated this constant from the official records and characteristics of four models. Of course this formula will only hold good for flights which are not the results of abnormal conditions, such as up-currents of wind, and the constant given is that corresponding to best performance due to maximum efficiency of the model.

One of the most important factors in duration flying is the propeller design, in my opinion, and experimental propellers of several designs should be tried out on each new machine.

The method which I have long used for propeller design consists of the following, essentially:

1. From the weight of the machine and wing area calculate the model's speed from the equation $V = 8\sqrt{\text{loading}}$.
2. Experimentally determine the glide. (With rubber on but propellers off.)
3. Calculate maximum duration by the formula given above.
4. Calculate the number of turns which may be given the rubber by the formula

$$\text{number of winds} = 4.75 \times L \sqrt{\frac{L}{\text{Wt.}}}$$

where L is length of rubber between hooks. Wt. is weight of rubber in ounces.

5. From the duration and number of winds allowed, the revolutions per second of the propellers can be figured.
6. Having the R.P.S. and the model's flying speed, the actual pitch may be found by dividing the flying speed by the R.P.S. This pitch is in feet and is only the actual pitch realized. I have found that this actual pitch realized is only about 60% of the theoretical pitch for the usual type of true-screw propeller, and in order to lay out the propeller from the design data given, it is necessary to give them a measured pitch of ten sixths of that which was calculated.

Having the pitch and the R.P.S. required, it is now necessary to give the proper blade width to satisfy the R.P.S. conditions. This is difficult to do and should be done experimentally. This can best be done by making the propellers of the correct pitch but with a blade width which keeps the speed below that required, and then cutting down the width until the speed is satisfactory.

Distance of Flight

The distance which a model will cover in calm air can be found by the product of the flying speed and the duration, each of which has been calculated. Actually, practically all distance meets are held with some wind blowing and this adds considerably when the wind is strong. Were all distances measured on a calm wind basis, the maximum would probably be in the neighborhood of 2000 feet, whereas I have seen two flights of over 5000 feet measured and quite a number better than 4000 feet. Obviously the difference between 5000 and 2000 feet must be attributed to the action of the wind, and in designing a machine to take advantage of the wind it is necessary to build it somewhat stouter than a duration machine is made.

The wing must be stronger and the model should be a trifle overpowered in order to be able to stand the wind gusts without losing altitude. With these exceptions a distance machine does not differ from one designed purely for duration.

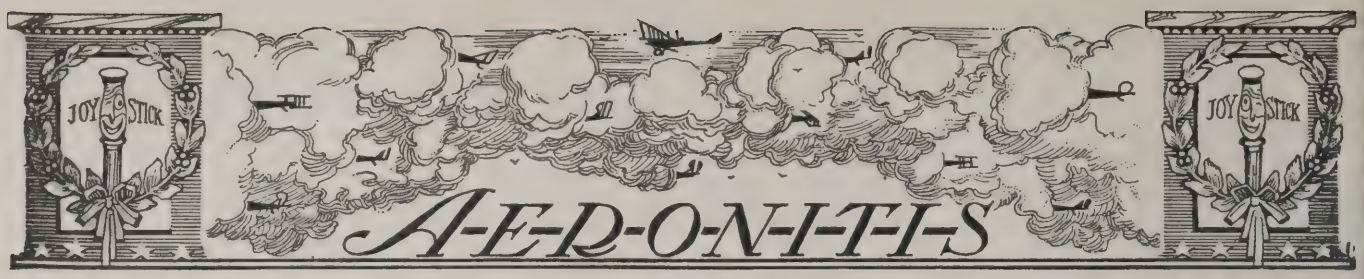
Quality of Flight

It goes without saying that all models must be stable under all conditions and this stability is usually attained by means of longitudinal and lateral dihedral angles. The front surface is given an angle of incidence greater than that of the rear surface. Usually the rear surface has no angle with respect to the motor base, while the front surface is given an angle of three to ten degrees. A lateral dihedral within the same range is generally given to the main plane, while the elevator, in the case of a pusher machine, may be given a much greater angle. In the case of distance machines the elevator may have as great an angle as 45 degrees. This high dihedral aids in controlling the machine on a straight flight.

Tractor models need a greater dihedral angle than do the twin pusher models. A high fin in combination with a large dihedral gives good stability to a tractor. A negative dihedral in the tail plane of a tractor seems to improve the wind-fighting qualities of this type of model also.

The proportioning of the main plane and the elevator of a pusher can be carried out between rather wide limits. A main plane area four to six times as large as the elevator gives very good results. For rise-off-water machines, the elevator should be somewhat greater in area in proportion to the main plane than for the hand-launched type in order to counteract the disturbing influence of the floats. A ratio of four to one gives satisfaction for this type of model.

(To be concluded in next week's issue of Aerial Age.)



R. O. T. C.

For a below stude means—Read Over Ten Chapters.
For a tired business man—Run Over To Club.
For a football player—Rush On Through Center.
For an upper-classman—Rare Over The Co-Eds.
For the dogs around Penn State—Roam Over The Campus.
For your roomie—Roll Over There, Charlie.
For the Co-Eds—Rise, Obey Thy Cupid.

To You

Slim dainty nothingness!
Enhanced by none but
Thine own fair grace and beauty,
To thee I lift mine eyes at break of day
Thy clinging caress feel,
Thy lingering thouch of softness,
When I surround myself in thee—
My B—
My B. V. D.

The Wail of A Lost Soul

O woe is me! A little flea,
Has in my boudoir recently,
Raised up a fighting family;
And now at night I scratch and bite,
And suffer while those armies fight;
I cannot eat; I cannot sleep;
I feel them jump; I feel them creep;
O save me from my punishment,
Please teach those fleas disarmament!

Quite So

Young Lady (to small boy)—"Little boy, does your father know that you smoke cigarettes?"

Small Boy—"Naw! No mor'en yers knows you talk to strange gennemens on de street widout the proper intreduction."—*Virginia Reel.*

A handsome young feller named Smith
Once asked a sweet maid for a kith,
She replied with a nod,
Then lithped, "O my God
I wonder if Heaven's like thith."—*Puppet.*

She—"Do you know I find it so much colder out here than it was back home? There I wore light garments all winter, but since moving here I have had to put on heavier clothing. I'm from Oregon, you know."

He (with a polite show of interest)—"Is that so? I'm from Missouri."—*Burr.*

He—"What do you call that part of your skirt under the lace?"

She—"Oh, that's a slip."

He (blushing)—"Oh, I beg your pardon."—*Ghost.*

There was a young woman from Detroit
Who at dancing was very adroit
But one day she slipped
And—oh! something ripped!
Thank god! 'Twas the hem of her skoit.

A Prescription

The thirsty soul which craveth drink
Should saturate itself with think.
Just cogitate upon this please,
You find a nip is in the breeze.
Of wind or winter, take your pick,
For either of them has a kick.
Mix well, and with them, while you snooze.

Biting the grass roots
Is young Jack Spry
He raced with an engine—
The race was a tie.—*Missouri Showme.*

Inquisitive Old Lady—"Now do tell me about your first success."

Wearied Young Author—"Well, you see, madam, I was crossing the ocean last summer and was a contributor to the Atlantic."—*Lampoon.*

Our Worst Enemy

Your low-stunt stuff is all the bunk,
Where mishap turns good planes to junk.
Through molding skulls, from out the past,
Hasbens look on—you are the ass!

For watching eyes you "climb the 'hack,"
Your failing motor slides you back.
The "Reaper" waits beyond that zoom:
The chandelle spells an early doom.

You try a down-wind turn, just off the ground,
"He crossed controls," they tell the town.
You used left rudder—instead of right—
From there the angels marked your "line of flight."

Now to give the girls a regular treat!
For low-turned loops are just your "meat."
Your moves were right, you made the try!
But boobs like you should use more sky.

Or perhaps you'll try a spiral, tight!
To show the gulls what's meant by "flight."
Yol were good and piled her right up on the "T,"
Your "spiral" spun you to Eternity.

And thus it is, the ranks must grow
Of those who don't, but think they know.
They break fool necks and hurt the game,
They class us all as nuts who may be sane.

That low-stunt stuff is obsolete,
You buck a game that can't be beat!
The flower of fooldom watch you from beyond,
Where tombstones bar their sky at dawn.

—*A. A. C.*

Adventure

I've been eaten by sharks in Calcutta.
I've been eaten by men in Fiji,
I've been buried alive in Sahara,
And drowned in the Caspian Sea.
I've been flayed to death in Kamchatka,
I've been burned at the stake once or twice,
And when I was up in Alaska
I was frozen to death in the ice.
I've been torn by both tiger and lion,
I've been smothered to death by my wife,
And, pray, do not think I am lyin'—
For I lead an adventurous life.

—*R. N.*

There once was a foolish young goat
Who ate all that a verse-librest wrote.
He got indigestion,
Acute without question,
And moaned, "Now I see I'm the goat."

—*The Owl.*

"Yes, business is looking up here."
"How come?"
"It's flat on its back and can't look any other way."

—*Harvard Magazine.*

Tommy asked his sweetie, pretty Nancy Beck,
What she wanted for her birthday.
"Oh! Tommy darlin', somethin' for my neck."
Of course a pearl necklace was her hope,
But he bought her a cake of soap.

—*Jed.*

(*Continued from page 446*)

If the coefficient of total resistance in terms of wing area be taken, as before, as $C_D + .04$, (this assumes the equivalent flat-plate area to be 3.1% of the wing area), the total resistance of the aeroplane is:

$$\frac{W}{\frac{C_L}{C_D + .04}}$$

This is obviously a minimum for minimum area, and the radius of action would therefore be increased by clipping the wings if the amount of fuel carried remained constant. If, on the other hand, the proportion of fuel weight to total weight is constant the radius of action is independent of weight and area. In actual fact the proportion of weight carried as fuel increases with increasing area, and the radius of action is therefore actually largest when the area is largest. Whatever area may be selected, however, the best wing section is the one giving the largest maximum value of $\frac{C_L}{C_D + .04}$ a function which is tabulated below for a number of sections.

It is obvious that the requirements for covering a given distance with a minimum fuel expense are the same as those for covering the maximum distance with a given weight of fuel, and the same criterion therefore serves as a measure of commercial economy as well as of radius of action.

Name		Max. $\frac{C_L}{C_D + .04}$
U.S.A.	5	8.74
	15	8.55
	16	8.26
	17	8.45
	21	8.06
	27	8.78
U.S.A.T.S.	5	8.02
	10	8.37
	13	8.09
R.A.F.	6	8.41
	15	8.11
Göttingen	387	8.38

G. Choice of a Wing Section for Maximum Duration.

Flights of very long duration are seldom of great practical value in themselves, but the making of a new duration record always attracts enough interest and serves as a spectacular enough demonstration so that the requirements for securing maximum duration of flight must not be overlooked entirely.

If it be again assumed that the propeller and power plant efficiency are constant the securing of a maximum duration is simply a matter of cutting down the minimum power required, as the weight of fuel which the aeroplane can lift represents a certain definite number of horsepower hours, and any reduction in the power makes possible an increase of the number of hours. It is too obvious to require proof that the possible duration increases with increase of area, practically the only limit to the possible gains in this way being the drop in propeller efficiency as the speed of flight falls off with increasing area.

It has already been shown that the minimum horsepower required is secured with that wing section which gives the largest maximum value of $\frac{C_L^{3/2}}{C_D + .04}$. The conditions for maximum duration are closely akin to those for maximum climb.

CONTEST COMMITTEE
OF THE
AERO CLUB OF AMERICA

Request all owners (individuals or companies) of aircraft in the United States to register in order that the Committee may

1. Send, gratis, the Aero Club's Contest Rules for 1922, and notices of proposed aviation meets.
2. Assist local Clubs in organizing contests best adapted to the types of airplanes in their locality.
3. Have a record of airplanes and pilots available throughout the country in times of emergency.

—Use This Form—

Date.....

Contest Committee, Aero Club of America,
11 East 38th Street, New York City.

I / We } have..... { Airplanes / Seaplanes / Flying Boats / Dirigibles / Free Balloons } Make and Model.....
(Give number)

Motor, Make and Model.....

Maximum speed of.....m.p.h.

Capable of continuous flights of.....miles.

Cubic capacity of gas bag.....cu. ft.

Underwriters Laboratories Aircraft Registration No.....

Pilot's name .....

Address .....

Owner's name .....

Address .....

AA

DON'T JUST SAY—"VARNISH"

SAY

"AEROSPAR"

THAT IS THE NAME OF THE CLEAR AND PIGMENTED VARNISHES

NOW MADE BY

TITANINE, Inc., UNION, Union County, N. J.

FLYING SCHOOL

Our Graduates Are Satisfied

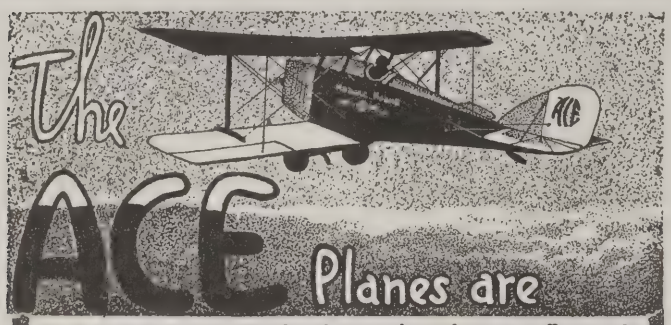
YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

PHILADELPHIA AERO-SERVICE CORPORATION

636 Real Estate Trust Bldg. Philadelphia



Built for the man who loves the air regardless of the business that calls him.

AVIATION SCHOOLS!
Solo students on the ACE

HORACE KEANE
Aero Planes
Sales Office: 903 Fifth Ave., N. Y. Inc. Factory: North Beach, Long Island

NOW AVAILABLE FOR YOUR AUTO

"The Plug That Cleans Itself"

Saves Gas **B-G** More Power

GUARANTEED CARBON AND OIL PROOF

Recognized as the best for aeroplanes, its success for automobiles is assured

B - G CORPORATION
33 Gold St., New York

If your dealer cannot supply you, send us his name and $1.00 for each plug, stating name and year of manufacture of your car.

MOTOR REBUILDING

CYLINDER GRINDING

ALUMINITE PISTONS

Iron Pistons, Piston Pins and Rings.

COMPLETE MOTORS

Parts for all airplanes and motors.

Finest equipment in U. S. for motor work.

GREEN ENGINEERING COMPANY

Dayton, Ohio
Main St., at Burns

L. P. WITHERUP

Mechanical Designing Engineer

Specialist on

Lubrication and Bearing Problems. I Make Your Own Bearings or Bushings Work Without Heating.

DESIGNING
DEVELOPMENT
DETAILS
DELIVERY
} of { Internal Combustion Engines of any type, class or service. Airplanes to Farm Engines. Invention Devices, Manufacturing, Air Compression, Pattern and Machine Work.

If you have a two-cycle engine giving you trouble or will not develop its full power, write me particulars and I will straighten it out.

LOCK BOX 1472, CINCINNATI, OHIO

New Aeroplane Supply Sale

Acetate Dope Guaranteed 55 Gal. Drum and 50 Gal. Bbls. $1.00 per Gal. No charge for containers. 5 Gal. lots $2.25 per Gal.

Spar Varnish, 5 Gal. cans, $2.25 per Gal.

Green Brown Wing Enamel, 5 Gal. cans, $1.50 per Gal.

TYCOS ALTIMETERS, register 20,000 feet radius, $15.00 each.

New Leather Aviation Helmets, $5.00 each, cost $18.00.

½" Brass Gasoline Stop Valves, $6.00 per Doz.

AC Spark Plugs Metrics $3.00 per Doz. $20.00 per hundred. $180.00 per M.

4" Barrel Turnbuckles $3.00 per Doz. $15.00 per hundred.

Wicker Pilot Seats, $4.00 each, $36.00 per Doz.

Tufted Fabricoid covered cushions for above $1.25 each.

Size No. 2½ Tinned Tacks, 15c per lb.

MAX TOPPER & ROSENTHAL
11th Ave. & P.R.R. Tracks Columbus, Ohio

Aerial Photographs

WE are always in the market for good aerial photographs, and we invite our readers to submit to us aerial views of landscapes, seascapes, forests, mining regions, etc. Address:

Photo Department

AERIAL AGE WEEKLY
280 Madison Avenue New York

January 23, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 20

TABLE OF CONTENTS

The Nationalization of the Aero Club of America 461
Air Mail Service Threatened..... 461
The News of the Week..... 462
Calendar of Coming Events..... 462
The Aircraft Trade Review..... 463
Log of Curtiss Seagull from Port Washington to Palm Beach..... 463
Aero Club Banquet Inaugurates Era of Aeronautic Co-operation and Co-ordination 464
The New Four-foot Wind Tunnel at the Massachusetts Institute of Technology 472
Goodyear Gear-Driven Airship.... 473
Naval and Military Aeronautics... 475
Foreign News 476
Elementary Aeronautics and Model Notes 477
Aeronitis 478

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

OUR AIM

TO ASSIST *in* DEVELOPING AERONAUTICS
until it becomes
THE FIRST LINE in TRANSPORTATION

TITANINE, Inc.,
Union, Union County, N. J.

Manufacturers of
DOPES :: PIGMENTED DOPES :: VARNISHES



The COLLIER TROPHY

for

"The Most Valuable Demonstrated Development in Aviation, during the Year"

Awarded to Grover C. Loening

for the

"Design, Development, and the Thorough Demonstration of the Airworthiness and Seaworthiness of the

LOENING AIR YACHT"

The WRIGHT TROPHY

"For the Best Completed Demonstration of Commercial Aviation"

Won by the LOENING AIR YACHT

Piloted by Clifford Webster

October 14, 1921

"In making six non-stop 100-mile flights between New London and the New York Airport (at Manhasset Bay), at an average speed of 120 miles per hour, with 100% performance, 100% safety over the water and with only two minutes variation in time of trips."

WORLD'S SEAPLANE ALTITUDE RECORD

Established on August 16, 1921 by

David H. McCulloch, formerly Commander U. S. N., in LOENING AIR YACHT

LOENING AERONAUTICAL ENGINEERING CORPORATION

NEW YORK

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., January 23, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, JANUARY 23, 1922 No. 20

The Nationalization of the Aero Club of America

THE nationalization of the Aero Club of America is being effected by embracing the plans of the National Air Association formed at the Convention held at Omaha, November 3, 1921.

The Special Committee appointed by the Board of Governors of the Aero Club of America, and the representatives of the National Air Association, have agreed upon the following plan of reorganization which only awaits the completion of legal formalities before it is put into execution.

The United States is divided into 9 Districts, corresponding to the Corps Areas of the United States Army Air Service. Two representatives will be elected in each District (Corps Area) to serve on the Board of Governors of the national body. One of these representatives will be elected Chairman of the District and becomes automatically, through this election, one of the Vice Presidents of the national body. One of these representatives must be an aviator.

Plan of Reorganization

There will be a President, 9 Vice Presidents, Board of Governors of 30; composed of 18 representing the 9 Districts (Corps Areas) and 12 elected at large.

Until elections can be legally held under this plan of reorganization, the following members of this Special Committee represent the Aero Club of America and the National Air Association: Caleb C. Bragg, Chairman, Contest Committee, Aero Club of America, New York City; Sidney D. Waldon, President, National Air Association, Detroit, Michigan.

Air Mail Service Threatened

THE Director of the Budget, Mr. Dawes, regarded the Air Mail as absolutely necessary and recommends $2,200,000 for the next fiscal year, July, 1922-July, 1923. The Sub-Committee of the House Appropriations Committee reduced that figure to $1,935,000. On January 11th, the House Appropriations Committee (Chairman Madden) entirely eliminated the Air Mail appropriation and reported the Post Office Bill to the House, on the floor of which the general Post Office Bill *is now being debated.*

If the Committee's action is sustained by the House and Senate there will be no Air Mail service in the United States after next July 1.

The Air Mail for the present fiscal year, 1921-1922, had an original appropriation of $1,250,000. which was later increased by a deficiency appropriation to $1,425,000. This has maintained the New York-San Francisco service, the only service now operated. It has a record of 89 per cent efficiency during the last year. More than 90,000,000 first class letters have been carried since the Air Mail was started, most of them across the continent. Service between the Atlantic and Pacific has been speeded up to between 48 and 60 hours, where 100 hours at least are required by all train service.

One hundred and five of the larger cities in the country have petitioned the Government to provide them with an Air Mail service.

The Air Mail planes cost practically nothing, as most of those in use have been obtained from the surplus supply of the United States Army, which otherwise would eventually have been scrapped, without use, due to deterioration through old age.

With the discontinuation of the Air Mail service, civilian, military and commercial aviation will suffer an almost irreparable loss, as the Air Mail service operating all the year round from the Atlantic to the Pacific gives:

(1) Research work embracing all phases of practical flying and a knowledge of the air conditions across the Continent during all seasons of the year (Military aviation is confined in winter to the fields in the sunny South).

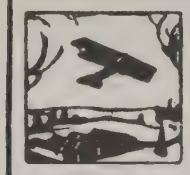
(2) It maintains a trans-continental Air Highway which will be used by civilian and commercial aircraft and can be used by military aircraft in case of an emergency. The aerodromes, hangars and shop facilities of this highway would be lost to aviation without the Air mail.

(3) The Air Mail service has and is developing the best group of practical aviators in this country, flying, as they are daily, cross country under anything but impossible flying conditions. Their experience and "flying sense" will be invaluable for the training of future pilots, and their practical experience of inestimable value to the engineers and constructors.

Civilian and commercial aviation will suffer a deplorable setback if the Air Mail is abandoned. Congress realized this a year ago, when the same committee cut the Air Mail appropriation. It was partly restored.

The National Advisory Committee for Aeronautics has urged the continuation and development of the Air Mail.

Your duty is clear. Support the National Advisory Committee in supporting the Air Mail and by writing or telegraphing your representative in Congress.



THE NEWS OF THE WEEK



House Committee Drops Air Mail Funds

Washington.—With provisions for the air mail service eliminated, the annual Post Office Appropriation bill, carrying approximately $554,000,000, was favorably reported Jan. 11 by the House Appropriations Committee.

As drafted by a subcommittee the measure provided $1,935,000 for the air mail service during the fiscal year beginning next July 1. The full committee, however, in approving the bill struck out this section. The total carried in the measure is $24,707,976 less than the appropriation for the current fiscal year, and $24,735,691 less than the amount requested by the Budget Bureau.

In explaining the elimination of the air mail service item, Chairman Madden said that opposition developed among members of the committee to the appropriation on the ground that transportation of mails by air had proved expensive and not particularly efficient.

For the current fiscal year a total of $1,425,000 was appropriated for the air mail service, the only route now in operation being that between New York and San Francisco.

Holds Design of ZR-2 Caused No Undue Risk

London.—No undue risk was taken in the design of the R-38 (ZR-2), and there was no change from previous practice, as regards safety, which experience or comparison with German airships did not make permissible, according to a report of the Admiralty Committee Board, included in a statement given out by the Admiralty Jan. 10th.

The statement embodies a report of the full investigation held in accordance with the decision of the Admiralty Board after the big dirigible exploded over Hull, England, in a trial flight last August, killing more than forty officers and men of the British and American navies. This occurred just before the vessel was to have been turned over to the United States Navy.

According to the statement, the evidence showed that no modifications were made in the main structure of the R-38 to October, 1919, when responsibility for design and construction was transferred to the Air Ministry. Though alterations were made in weight, nothing was done to affect the structural strength of the ship. No important alterations in design were made later, but there were some modifications, as a result of experiments, of fins, cars and other parts of lightness, which would not affect the strength of the structure.

The Heath Universal Propeller

There is now on demonstration at the works of The American Propeller & Mfg. Co., Baltimore, Md., a universal propeller designed by Spencer Heath and now in operation on a 4,000 pound land machine under full load and power conditions. The blades of this propeller can be adjusted universally in their sockets for any angle of forward or reverse pitch while the engine is running, the power of the engine itself being used to effect the changes of pitch. A light pull or pressure on a button is all that is required to produce any change of pitch desired. When the engine is at rest the pitch may be altered or reversed by turning a small hand crank located conveniently to the operator. The machine accelerates or decelerates or travels forward or backward in response to changes of pitch. At all times and during all changes of pitch the exact position of the blades is graphically shown by an indicator on the instrument board.

The speed of the engine is automatically controlled by the indicator mechanism so as to give the correct throttle position for every possible blade position and thus prevent racing or stalling the engine by manipulation of the pitch. The engine is subject at all times, however, to manual control of the throttle which may at any time interrupt and supervene upon the automatic throttle control. The entire operating mechanism is entirely disengaged and the blades securely locked at all times except during change or adjustment of the pitch.

Offices of Foreign Air Attaches

The office of Captain de Lavergne, French air attaché in Washington, D. C., is now located at 2635 16th St. N. W., and all correspondence should be so addressed. The telephone number is Adams 2414.

The office of Lt. Col. A. Guidoni, Italian air attaché, is located in the building of the Italian embassy, 1400 New Hampshire Ave., Washington, D. C. The telephone numbers are Franklin 6617 and Main 276.

Aeronautic Legislation

The following memorandum on aeronautic legislation was issued by the Aeronautical Chamber of Commerce:

Dec. 6. House. Mr. F. C. Lanham speaks in the House relative to the flight of the C-7 inflated with helium. Accomplishment marks a new era in aviation.

Dec. 10. House. Mr. Steenerson: A bill (H. R. 9462) to encourage commercial aviation and authorizing the Postmaster General to contract for air mail service, and prescribing rates of postage thereon; to the Committee on Post Office and Post Roads.

Dec. 12. Senate. Mr. Borah: (S. Res. 188) Directing the Sec. of War to send the Senate the report of Gen. Mitchell relative to the sinking of battleships at Langley Field, filed in September, 1921. Agreed to—See under Jan. 4, 1922.

Dec. 19. House. Mr. Parrish: A bill (H. R. 9635) to provide for flying pay for officers and enlisted men of the regular army who are incapacitated by reason of injuries incurred in or by aircraft accidents; to the committee on military affairs.

Dec. 20. House. Mr. Hicks: A bill (H. R. 9657) to authorize the Sec. of Commerce to establish a bureau of civil aviation in the Dept. of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce and for other purposes; to the committee on Interstate and Foreign Commerce.

Dec. 21. Senate. Mr. Walsh: (S. Res. 200) Directing the committee on naval affairs of the Senate to investigate the transfer and examination held in connection therewith of officers of the naval air service and members of the Naval Reserve Flying Corps. Ordered to lie on rule.

Jan. 3. House. Executive communication 443. A letter from the Acting Sec. of Navy transmitting a tentative draft of a bill for the purchase of the naval aviation station at Galveston, Tex. and appropriating $18,000 for same; to the Committee on Naval Affairs.

New Air Mail Hangar at Crissy Field

Mr. Caldwell, Air Mail Superintendent, has let the contract for a new hangar at Crissy Field. Work was begun on Nov. 28, and it is expected that construction will be completed and the hangar ready for occupancy in thirty days. The hangar now used by the Air Mail Service will be turned over for the use of the Reserve Squadrons now organizing in the vicinity of San Francisco.

CALENDAR OF COMING EVENTS

under sanction of

AERO CLUB OF AMERICA

April 30th (1 or 2 days)

Spring Show and Opening Meet

Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for

Detroit Aerial Water Derby

Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy

Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet

Pulitzer Trophy
Detroit Aerial Derby

for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races

Detroit News Aerial Mail Trophy

for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)

In Preparation by the Aero Club of America

American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th

First Annual Interservice Championship Meet

Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)

Foreign Events

Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)

Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

Additional A. C. C. Members

The following names have been added to the membership of the Aeronautical Chamber of Commerce:

Airship Manufacturing Co. of America, Hammondsport, N. Y.; Beckwith Havens, Airship Manufacturing Company of America, Hammondsport, N. Y.; C. C. Witmer, Airship Manufacturing Company of America, Hammondsport, N. Y.; C. M. Manly, New York City; B-G Corporation, New York City; American Hammered Piston Ring Co., Baltimore.

Aeroplane Exports

According to the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, aeroplane parts to the total value of $19,173.00 were exported during the month of November 1921, going to England, Canada, Mexico, Japan and Australia.

Aluminum Men Fear German Competition

Washington.—Unless the aluminum industry gets high protection it will be destroyed by German competition, J. M. Ramsey of Cleveland declared Jan. 9th before the Senate Finance Committee. He asked for a general rate of 45 per cent ad valorem on American valuation.

Wright Engine Instruction Book

The Wright Aeronautical Corp. has just issued a useful instruction book dealing with Wright engines.

The volume is bound in oil and water proof imitation leather, and is divided into three sections. The first is devoted to a description of their engines; the next deals with installation and operation; and the third division takes up the question of overhauling and repairing. There are also chapters giving tabulated data on Wright engines, and a list of tools necessary for their handling and repair.

The book is profusely illustrated, nearly all of the drawings being as plain as paper and ink can make them, the idea being to make the entire volume clear to everyone who is to handle these engines, be he pilot or mechanic.

Prices for Wind Tunnel Tests at the Massachusetts Institute of Technology

All the prices appended include the plotting of the customary curves and the furnishing of 2 sets of blueprints and a brief report. The prices given relate to tests which take their place in the ordinary order of work. Rush tests can be put through by overtime work at an increase in cost of from 25 to 100 per cent. The usual time for the completion of a test on a single wing or model is 10 days from the receipt of the model to the despatch of the report, but this time can not be guaranteed.

All tests will be run at a wind speed of 40 M.P.H. unless otherwise requested. The highest speed possible is 65 M.P.H. Models should be approximately 18 inches in span and should not in any case exceed 24 inches. Fuselages and airship forms may be from four to six inches in diameter. No model should weigh over four pounds, and the lighter the better. In constructing models the methods outlined in Report No. 74 of the National Advisory Committee for Aeronautics (Construction of Models for Wind Tunnel Test) should be followed. Models can be constructed at the Massachusetts Institute of Technology if desired, the average cost being $22.00 for a rectangular wing model of constant section and from $40.00 to $100.00 for a tapered wing.

Type of Experiment	Price
Single rectangular wing of constant section, lift and drag	$25.00
Do., with c. p. travel	30.00
Single wing of varying chord or section or with dihedral, lift and drag	30.00
Do., with c. p. travel	40.00
Complete model, lift and drag	35.00
Do., with vector diagram or pitching moment curve, as desired	45.00
Extra charge for running any of the above at 2 speeds	12.00
Do., 3 speeds	20.00
Each additional moment curve plotted from the same test	7.00
Each additional elevator or tail-plane setting on same model	20.00
Biplane or triplane combination, lift and drag	35.00
Test of each wing of biplane combination in presence of another, lift and drag	60.00
Do., triplane combination	85.00
Fuselage or other simple parasite resistance test, one angle	15.00
Do., several angles, with pitching or yawing moments	25.00
Test of stability in side-slip (yawing moment, rolling moment, and cross-wind force at angles of yaw)	100.00
Do., each additional setting of controls on same model	40.00
Test for longitudinal damping coefficient	125.00
Do., each additional tail or other change in condition on same model	40.00
Test for downwash on tail-plane, including routine test for lift and drag	90.00

These prices are subject to change without notice and a new price list will be issued not later than June 1, 1922. Work not covered by the above specifications will be charged for in proportion to the amount of labor required and the time during which the tunnel is occupied.

Outspinning the Spider

Under the title "Outspinning the Spider," John Kimberly Mumford, who has written a number of books on industrial subjects, tells for the first time the history of wire-rope making in this country, from the beginning of the industry in 1840 by the John A. Roebling Sons Co.

"Outspinning the Spider" relates the romance of the Brooklyn Bridge; of the wire rope barrage laid down in the English Channel during the late war, and other interesting engineering achievements.

Copies of this interesting booklet can be secured from the Robert L. Stillson Co., 8th Ave. and 33rd St., New York City.

LOG OF CURTISS METROPOLITAN COMPANY'S "SEAGULL" NO. 1 FROM PORT WASHINGTON, N. Y., TO PALM BEACH, FLORIDA, DECEMBER, 1921

PILOT—CLIFFORD L. WEBSTER. MECHANIC—HORACE WILSON.

To	*Miles*	*Minutes*	*Average Alt.*	*Relative Wind*	*Date*	*Remarks*
Atantic City, N. J.	115	149	20 feet	Fresh head.	December 10	Rough air and water.
Churkategue, Va.	120	144	10 feet	Fresh head.	December 10	Rough air and water.
Manteo, N. C.	160	122	1500 feet	Moderate following.	December 11	Good air.
Beaufort, N. C.	110	115	2500 feet	Strong side.	December 11	Good air, rough water.
Swansboro, N. C.	25	30	10 feet	Light head.	December 11	Good air, rough water.
Southport, N. C.	75	87	10 feet	Fresh head.	December 12	Rough air, rough sea.
Charleston, S. C.	153	162	10 feet	Fresh head.	December 12	Rough air, rough sea.
Tybee Island, Ga.	92	100	10 feet	Moderate head	December 12	Rough air, rough sea.
Fernandina, Fla.	105	111	10 feet	Moderate side.	December 13	Rough air, smooth sea.
Titusville, Fla.	160	156	300 feet	Moderate side	December 13	Moonlight, good air.
Palm Beach, Fla.	142	116	1200 feet	Moderate following.	December 14	Good air, smooth sea.
	1257	1292				

Start: December 10, 1921, at 10:11 a.m. Finish: December 14, 1921, at 9:30 a.m. Elapsed Time: 3 days, 23 hours, 19 minutes. Flying Time: 21 hours 32 minutes. Gas Consumed: 265 gallons. Oil Consumed: 12 gallons. Average Motor Speed: 1550 R.P.M.

Notes: Excepting that obtained at Atlantic City, gasoline was the ordinary grade of Texaco and Standard Oil gas. Mobile Oil, B, was used when procurable; at other times Polarine and Texaco heavy oils were used. The motor ran perfectly. No attention was given it other than supplying gas, oil and water and draining gasoline strainer. This motor had over 550 hours flying before the start of the trip. The plane and hull required no repairs or adjustments. Over half a day was lost at Tybee Island, Georgia, waiting for a strong head wind to shift. Start was made at 3:30 p.m.

CLIFFORD L. WEBSTER (Pilot.)

AERO CLUB BANQUET INAUGURATES ERA OF AERONAUTIC CO-OPERATION AND CO-ORDINATION

THAT the 14th Annual Banquet of the Aero Club of America inaugurated a new era of co-operation and co-ordination in aeronautics was the consensus of opinion of everyone present. Congratulations are due the officers and governors of the Club on the success of their efforts.

The Hon. Benedict Crowell, president of the Aero Club of America, was the presiding officer, and he was accompanied on the platform by Charles F. Kittering, toastmaster, and the following honorary guests:

Rear Admiral W. F. Fullam, U. S. N.; Major General Mason M. Patrick, A. S., Chief of Air Service; Rear Admiral William A. Moffett, U. S. N.; Honorable Fred C. Hicks, Jr.; Captaine de Lavergne, French Air Attaché; Lieutenant Colonel A. Guidoni, Italian Air Attaché; Captain St. Clair Streett, A. S.; Captain George W. Hamilton, U S. M. C., and Captain Eddie Rickenbacker.

The Speeches

PRESIDENT CROWELL: Gentlemen, in behalf of the Aero Club of America I am pleased to welcome you, Guests and Members, to this, the Fourteenth Annual Banquet. During the last few years, especially since the last Banquet of this Club, the World has been changing very fast, and in nothing faster than in aeronautics.

It is necessary for this Club to keep pace with these changes, and we are about to be made into a National Association. The National Air Association and other organizations are about to join forces with us, and to work for a common end. In fact this day a Committee was appointed to work out the details of the National Association.

The main purposes of the Club are, briefly, these:

1. Recognize the broad national aspects of the Club's responsibilities and plan for an immediate attack of those problems which lie within the province of a civilian body devoted to the development of the aviation art.
2. Remove the headquarters of the Club to Washington and separate the activities from all social functions of a local or clubhouse nature.
3. Make the Aero Club of America a truly national business institution for the furtherance of American aviation in all its phases—a body representative of all proper aviation interests and of every section of our country.
4. Devote the influence and strength of the Club to the promotion of the national security and welfare through aviation development along the following general lines:
   (a) Securing the enactment of the basic legislation necessary to Federal Control of the Air.
   (b) The establishing of a governmental agency charged with responsibility for the Federal examination and license of pilots, and for the periodical inspection and safety of all aircraft and their equipment—to the end that flying may be made safe and the public welware properly guarded.
   (c) The adoption by the Government of a comprehensive and continuing national policy of aircraft development—including the mapping of air routes, the establishment of aerodromes, the maintenance of communicating and meteorological services, etc.
5. Effect the formulation of the rules and regulations for the Government of all kinds of aeronautical trials for contests and the promulgation and proper administration of these rules.
6. Accept the responsibility for the verification and certification of the results of all trials and contests and of all records arising therefrom.
7. Collect and disseminate to Club Members aeronautical information of all kinds.
8. Serve as the American representative of the F. A. I. and actively participate in all international aviation projects.
9. Bring about an affiliation with the activities of the Aero Club of America of all responsible bodies whose energies are directed to the development of any phase of our national air development.

It is even possible that a slight change in the name of the Club will be made. Among the immediate interests is our helping forward the Wadsworth-Hicks bill now before Congress, and to that end I am going to ask for the adoption of this resolution:

Resolution

Whereas, the Aero Club of America is a national organization, including in its membership the principal and various elements actively concerned with developing the art and science of flight most advantageously for the Government and for the nation at large; and

Whereas, it is now apparent that the National Government should provide for Federal supervision and regulation of aircraft and aerial activities among civilians, and that the chief executive and administrative heads, chiefs of bureaus and others dealing with aviation are unanimous in their support of the bill recently introduced in the Senate and in the House, i.e., Senate Bill No. 2815 (The Wadsworth Bill) creating a Bureau of Civil Aviation in the Department of Commerce "to encourage and regulate the operation of civil aircraft in Interstate and foreign commerce; and for other purposes,"—

Therefore, Be It Resolved, That the Aero Club of America, at its Fourteenth Annual Dinner, in the City of New York, recommends immediate and decisive consideration of the abovementioned bill; and

Be It Further Resolved, That the Secretary of the Aero Club of America be instructed to mail copies of this Resolution to the President and the members of the Senate, and the House, representatives of the Congress of the United States, to the Clerks of both houses and to the Secretary of Commerce.

I am going to ask for the endorsement of that Resolution. (Motion for the adoption of the Resolution was seconded and carried unanimously.)

I shall now ask Mr. Edwards to conduct the program for the next few minutes.

MR. CHARLES JEROME EDWARDS: Gentlemen, this is a very great privilege which I am now to enjoy.

You men of the Aero Club of America and friends of aviation are here to-night to take part in the presentation of these trophies and certain other medals of award.

Trophy and Other Awards

The first Trophy, and it is one that has taken place—large place—in the annals of Aviation, is the Pulitzer Trophy, won this year by Bert Acosta. You will all understand and sympathize with him when I tell you his absence from this meeting to-night and the opportunity for us to pin this Medal on him, is occasioned by a most sad occurence in the most intimate relations of his family life.

He won this Trophy in a Curtiss Navy Racing Plane, equipped with a 12-cylinder, direct drive Curtiss motor. Mr. Acosta established a world's record of 176 miles per hour for competition over a closed circuit; the previous record of 173 miles per hour having been made in October in the Race for Coupe Deutsche de la Merthe, and won by Sadi Lecointe.

The Medal of Merit of the Aero Club of America has been awarded by the Board of Governors of the Club to Mr. Acosta for this record.

I will ask Mr. Post, if he is here, or some representative of the Aero Club, to take charge of this Medal for the World's Cross-Country Speed Record of 176.7 miles per hour, made in November, 1921, to see that it reaches Mr. Acosta.

The next is the Mackay Army Trophy, competed for annually by army officers in the Air Service. It has been awarded by General Patrick to Lieutenant Macready, for establishing a new world's altitude record of 37,800 feet in a LePere aeroplane, with a 12-cylinder Liberty motor, equipped with a Morse supercharger.

The Medal of Merit of the Aero Club of America has been awarded by the Board of Governors of the Club to Lieutenant Macready for this record.

Now, we have here the Medal of Merit of the Aero Club of America which has been awarded by the Board of Governors of the Club to Messrs. Stinson and Berthaud for establishing a world record of endurance by remaining in the air 26 hours, 19 minutes and 35 seconds. This feat was accomplished with a Larsen all-metal monoplane. They got their pictures in the papers and in the movies; and we are darn proud of them as they did a big thing for America and for the Aero Club and for an American manufacturer. And the strange thing is, they remained in the air for these 26 hours and 19 minutes using coffee only. That is what they said, anyway—and it was on the 29th and 30th of December, which beat the former record made in France.

On behalf of the Aero Club's Governors we bid these gentlemen step forward and let us place these medals in their possession.

Now, we have the Collier Trophy, presented by Robert J. Collier, to be awarded annually for the greatest achievement in

Aviation, the value of which has been thoroughly demonstrated by use during the preceding year. It has been awarded for 1921 to *Mr. Grover Cleveland Loening for his development of the Loening Flying Yacht,* which attains a speed of 135 miles per hour, reached an altitude of 17,500 feet with four passengers, and has thoroughly demonstrated its air worthiness and its sea worthiness by constant use over a period of three months.

We will undertake to see that the custody of the Collier Trophy is placed with Mr. Loening.

The next is the *Wright Trophy,* donated for the best completed aerial demonstration to or from New York City within eight hours, judged entirely in a non-technical way, and from a prospective buyer's standpoint; it also has been awarded to *Mr. Grover C. Loening* for the six flights made in his flying yacht between Port Washington and New London, based upon 100 percent performance, 100 percent safety. The flight being made in a water-machine over an all-water route, in 33 percent of railroad time, and with a variation of only two minutes in trips in the same direction and of only sixteen minutes greatest variation between any two trips.

We regret that the Trophy has not at this time been completed, and so cannot be delivered at this time.

The next is the *Larsen Efficiency Trophy.* The Aero Club of America cannot announce the winner of this contest at the present time, owing to an appeal having being made to the Aero Club of America against the decision of the Aero Club of Omaha. This appeal has been under consideration, and is now under consideration by a Special Committee appointed by the Board of Governors of the Club; but due to the nature of the evidence the Committee has had to take more time than would ordinarily be required in deciding a sporting event. This takes me back to the year 1910, when Grahame-Wihte worried us, and then charged us six percent interest for the money we held in trust.

Now, we have presented these trophies obtained for success by our pilots in 1921. What about 1922? The more important trophies exhibited will be competed for as follows:

The Curtiss Marine Trophy at Detroit, Michigan, above the Detroit River and Lake St. Clair, on Labor Day, September 4th, preceding the Gold Cup or International Hammondsworth Trophy Motor-Boat Races. Detroit, the fourth largest City in the United States and the center of the Great Lakes population last year, had 400,000 people on the shores of the City and Belle Isle to witness the Motor-Boat Races.

The Aero Club of America knows of no better place, geographically than Detroit, to introduce seaplane and flying-boat contests, nor of any location that has the enthusiasm over water sports.

The Pulitzer Trophy Contest will be held in Detroit, starting and finshing at Selfridge Field at Mt. Clemens. This field has every facility and the proposed course offers ample landing fields in case of mechanical failure.

The Detroit Aviation Society assures the contestants of efficient management.

In addition to the Pulitzer Trophy there will be contests for the Detroit Aviation Country Club Trophy, Liberty Engine Builders Trophy and Detroit News Aerial Mail Trophy. These will embody contests for single and multi-motored commercial planes.

The Aero Club has in preparation an Inter-Service Championship Meet similar to the championship tournament of any sport, in which the representatives of the Army, Navy and Marine Corps Air Services, previously selected by elimination trials, or other rating, meet to decide the individual and interservice championship for the year.

The Aero Club hopes that America will be represented in 1922, both in the Coupe Henry Deutsche de la Merthe, and the Coupe Jacques Schneider, for seaplanes and flying boats, which are the important foreign races; and we should not neglect the opportunity offered us to compare our development with theirs.

I now come to the Petition—and I am compelled to say that *Caleb Bragg* is the most efficient, most untiring and most unselfish Chairman we have ever had on the Contest Committee; and his fidelity to the job has been as great if not greater than any man I have known in like relationship in my long and happy connection with Aviation. Mr. Bragg got this up.

Due to the great number of requests to send Government aeroplanes to all parts of the country to participate in patriotic celebrations, municipal and State functions, conventions, air-meets, etc., received by the Air Services, these Departments were compelled to bring the matter to the attention of the Secretary of War, who issued an order that no Government aeroplane should participate in any of the above events. Unfortunately no provision was made which permitted the Air Service to participate in the events organized, with their approval and under their direction, by the Aero Club of America.

Therefore, a petition to the President of the United States has been drawn up and adopted by the Board of Governors of the Aero Club of America, which I shall read, and—with the approval of General Patrick and Admiral Moffett will submit to you gentlemen for your adoption.

The petition was then read.

MR. EDWARDS: I will ask now if you will hear General Patrick second this Resolution or Petition.

GENERAL MASON M. PATRICK: Yes, Mr. Edwards, I second it most heartily.

MR. EDWARDS: I will suggest another seconder; and I name Admiral Moffett.

ADMIRAL MOFFETT: Speaking for the Navy I heartily second that; and as far as I am concerned the Navy will go into each and every one of these races.

MR. EDWARDS: The Chairman has asked me to put the question as to this petition which has been so heartily seconded by both the Army and the Navy. Are you ready for the question? (Shouts of *Yes*). All in favor say Aye. That is fine. There can be no Noes there. It is adopted unanimously. (Petition handed to President Crowell.)

PRESIDENT CROWELL: It is now my great pleasure to introduce to you as your Toastmaster one who needs no introduction, I am sure,—*Mr. Charles F. Kettering.*

TOASTMASTER CHARLES F. KETTERING: Mr. Chairman and Gentlemen, you know I could not help as I sat here but contrast this Dinner with some we have had previous to this, "in the good old days" before the Country went dry, when the speakers as well as the guests had something to drink. Not having it makes the problem up here a little more difficult.

You know while Mr. Edwards told all about the 400,000 people who collected on the shores of Lake St. Clair to view the motor boat races, he did not say on which side of the river they were. Detroit, let me assure you, has other attractions than merely being fourth city in population.

Now, we have a long program tonight, and I regret it as I have to cut my own stuff short.

First we have a lot of letters and telegrams which I shall read:

Greatly regret my inability to accept your invitation and be with the Aero Club at its Banquet tonight. I shall hope that the occasion may bring further encouragement to American interest and effort in the growing field of aeronautics.

(Signed) PRESIDENT HARDING.

I have your letter of December 29th inviting me to be the guest of the Aero Club of America at the Fourteenth Annual Banquet to be held at the Commodore Hotel, New York, on Monday evening, January 9th, 1922, and regret that an engagement in Washington for that day will prevent my accepting your cordial invitation.

(Signed) JOHN M. WEEKS, *Secretary of War.*

Impossible for me to leave Washington today much as I would like to be on hand tonight to help in the good work that is being done by the Aero Club. Best wishes to all for the New Year.

(Signed) E. H. SHAUGHNESSY.

Greetings for the New Year. Development of Aeronautics both Commercial and Military is taking precedence over any other transportation or national defense agency in Europe. Keep up the good work of developing our aeronautics.

(Signed) MITCHELL.

Sorry I am unable to be present tonight. Please extend my greetings to the members and guests of the club. The past year has been one of unusual progress in aeronautics toward which progress the Aero Club has contributed its full share. Wishing you a most successful meeting, sincerely yours,

(Signed) ORVILLE WRIGHT.

I regret most sincerely my inability to be present at 14th Annual Banquet and offer best wishes for its success and the success of aviation and the aeronautical industry of America in general and in particular.

(Signed) AIR COMMODORE CHARLTON.

I have just wired you as follows: "Regret impossible to accept invitation to attend banquet of Aero Club January ninth. Most appreciative of invitation."

I very much regret it isn't possible for me to accept the invitation. I have been away for three weeks getting a short rest, the first I have had since 1914, and must stick to the job here now for the next few weeks. I am very sorry I can't come. Nothing would give me more pleasure than to be with you, as you know I am very much interested in aviation.

(Signed) WILL H. HAYS.

Your letter of December 29th, 1921, inviting me to be the guest of honor at the Fourteenth Annual Banquet of the Aero

Club of America, to be held at the Commodore Hotel, New York City, on Monday evening, January 9th, is brought to my attention on my return after a short absence from the city. I regret very much that I cannot be with you. I am to be in New York on January 10th, but press of official duties here will not permit me to extend my absence from Washington for a single day. I appreciate your courtesy, however, and wish it were possible for me to accept.

Will you be good enough to convey to the members of the Aero Club and their guests my best wishes for a pleasant and profitable evening.

(Signed) EDWIN DENBY.

Rear Admiral W. F. Fullam's Speech

Mr. Toastmaster and gentlemen of the Aero Club of America:

I cannot feel that I deserve the compliment of addressing you tonight. The world is facing a new era, an era which will bring aeronautics to the front and give it a proper place in peace and war.

The Conference in Washington has decreed the scrapping of 66 battleships and a holiday of ten years in battleship building. This momentous decision stops a mad race in enormously expensive ships that are doomed by modern weapons. It saves hundreds of millions, reduces taxation the world over and lessens the danger of war in the near future.

For these reasons alone every man, woman and child in the world should pray for the ratification of the decrees of this Conference, by all civilized nations. To defeat or reject the righteous measures agreed upon by the delegations to this Conference would be a crime far more reprehensible than that of the German Kaiser in 1914. There would be a less excuse for such action today than there was for the militaristic spirit that precipitated the World War. The picking of petty flaws, and the carping criticisms of the Conference with a view to wrecking a wonderful accomplishment, will not be tolerated by the people of this country.

Wars Will Not Cease

But it must not be assumed that wars will cease forever. Pacifists must not beguile us into a state of effeminate unpreparedness. In discouraging wars, in condemning aggression, in abolishing inhuman methods, in protecting neutrals, non-combatants and innocent commerce and in reducing expenditures for out-of-date weapons we must not throw all reason overboard. We must recognize that human nature has not changed. Jealousy, envy and greed still exist among the nations of the earth. We see proof of this in the proceedings of the conference that has done so many splendid things in the past two months! We can only postpone war. We can only reduce the number of wars by removing causes that are plainly inviting immediate hostilities.

The Conference Modernizes Naval Thought

One of the most importane results of this Conference is to modernize naval thought, and set naval and military minds free from the thralldom of conservatism. Our naval policy was virtually based upon one lone idea—the battleship. The naval brain, during the past eight years has harbored but one thought—battleships. It saw nothing but battleships and battle cruisers, it dreamed only of them. It was tortured with the superstition, with the nightmare of the battleship!

This statement will be considered an exaggeration by certain conservative naval officers. They will claim that our policy included the building of other types of ships, and the encouragement of other weapons like submarines and air forces. But in truth, these weapons were advocated in whispers, while the need of battleships was sounded by a megaphone. Money was poured out for capital ships, but it was vouchsafed in miserly pittances for the new weapons that are essential in modern war. I know this from personal experience. A statement to the Senate advocating a fleet of 21 dreadnoughts and the suspension of the 1916 program beyond that, in order to provide money for submarines, aeroplane carriers and aeroplanes, was received with impatience and hostile action!

"Battleshipitis"

The feeble statement by Congressmen and others that the principle of a three-plane-navy was recognized by the advocates of the 1916 program resulted in no action to support this intelligent declaration. There were hundreds of millions for capital ships and comparatively nothing for the forces in the upper and lower planes—for air forces and submarines.

But the Conference has provided a tonic that may cure this awful disease of "battleship*itis*." If we are to build no more of them for ten years, naval officers may turn their minds to the development of something else. The one idea which completely filled their brains may now to be permitted to hybernate so that two or three other ideas may find birth and nourishment. There is hope.



Mackay Army Trophy
Presented by Clarence H. Mackay.
Won by Lieut. Macready for establishing a world's altitude record in a Liberty motored Le Pere

And it must be recognized that this naval malady, "Battleshipitis," was not restricted to the United States. This naval plague was found everywhere. It raged in England and Japan, and other nations were saved from it only because they could not raise the billions necessary to create battleship fleets. It threated to bankrupt the world.

Conservatism in the Navy

The craze for battleships in 1922 was born of conservatism. In a recent lecture at the Naval War College, Admiral Sims demonstrated that conservatism has always kept military minds in a rut from the days of Noah. Let me briefly review our own Naval history. In 1862 the Monitor and the Merrimac proved that wooden ships were useless against armored ships in war. Had the Merrimac beaten the Monitor she would have raised the blockade and won the war for the South. Farragut, with his wooden ships, triumphed simply because the South had no navy.

Following the Civil War, we profited little by its naval lessons. We had virtually developed the all-big-gun ship, the Dreadnought of today. The Monitor contained all the germs. The double-turretted Monitors Miantonomah, Monadnock, Puritan and Terror were low-freeboard Dreadnoughts. The Monadnock rounded Cape Horn, the Montonomah cruised to Europe. This proved that the Monitor was a sea-going fighter. It was the most powerful ship afloat.

Foreign Nations Outshipped U. S.

But we stopped, while other nations progressed. We returned to antique wooden ships, while European nations built iron and steel ships and developed the modern battleship. I cruised in the Mediterranean from 1877 to 1879 in wooden ships, the Marion and Trenton. It was humiliating. In every port we found armored ships of Italy, Austria, France and England. Italy had the Dondolo and Duilio with their hundred-ton guns. The Stars and Stripes were carried by wooden arks with 9-inch smooth bores or converted rifles! The Trenton, the pride of the navy, was a wooden cruiser with a ram bow. Sticking out 100 feet ahead of the ram was a bowsprit, a jib-boom, and a flying jib-boom! Towering spars, and yards on three masts, were loaded with the rigging and sails of a full powered sailing ship! And it may be said that this top-hamper sent the Trenton to her doom in the Harbor of Apia a few years later. She could not steam against a hurricane, and force her way to safety in the open sea, following the British cruiser Calliope —a modern ship!

Clinging to Sails

And strange to say, we still clung to sails for fighting ships. In 1887 to 1889 I cruised in the Boston and Chicago of the



The Collier Trophy awarded to Grover C. Loening for his development of the Loening Flying Yacht

"White Squadron." They were loaded with masts, spars, topsails and top gallant sails! We could not give up this ancient impediment in a modern naval age!

And so it happened that until we built the grand old Oregon, the Massachusetts, and the Indiana—more than 30 years after the Monitor and the Merrimac—we were sleeping in the arms of Conservatism, building wooden ships and sailing vessels, while foreign nations were designing fleets of modern battleships, any one of which could have sunk our entire Navy!

The Conference Sets Us Free

Now, gentlemen, is it not plain that the same conservatism that stifled progress in our Navy for thirty years following the Monitor and the Merrimac might have continued to hold naval officers and Naval Committees in double irons had not this Conference stopped the mad battleship mania and struck the shackles from enslaved naval minds! How long would we have waited for a recognition of modern weapons with naval brains so hidden behind the armor of our Dreadnoughts that the light of a new era could not penetrate? But the Conference has decreed a scrapping carnival, and a ten-year battleship holiday. Naval intelligence may now come from behind armor and assert itself. It may get on the road to progress and provide us with a modern navy—a three-plane-navy. It may distribute the appropriations wisely on the three planes, and it may develop a type of surface vessel which will be less expensive, less vulnerable, and more useful then the $45,000,000 Dreadnought of today. We *must* have a surface Navy. There can be no Navy without ships. There will always be fighting ships upon the sea. It is a question of types—that is all.

Gentlemen, in condemning conservatism, we must admit that it has some virtues. We must be fair. In the indictment of a one-idea navy we must not convict ourselves of being the slaves of one idea—the victims of *some other* than the battleship mania! In avoiding Scilla we must not fall upon Chribdis!

Conservatism Has Virtues

Conservatism at the Navy Department has often served a good purpose. There is reason in all things. If the Navy Department had accepted every innovation, every invention, and had changed its building policy to accord with the views of every invention, and every theory advanced and urged during the past fifty years there would have been no money left in the United States. There would have been a scrap-heap of useless contraptions higher than Mt. Everest, and the Navy would have been successfully controlled by crazy, half-baked theories which would have brought us to zero in Naval efficiency.

Avoiding Extremes

And so, we must always be conservative within limits. We must distinguish between things that have been proved and things that are un-proved. We must never claim too much for a new invention or a new weapon. In doing so, in overstating our case, we weaken our position and reflect upon the soundness of our judgment. In promoting Aviation in the Navy, for instance, we must not claim that all surface ships and all Dreadnoughts must be immediately scrapped. We must keep what we have until we get something better. We can not jump overboard off our battle fleet and swim around in the Atlantic and Pacilc Ocean with nothing to land upon!

The Conference at Washington has intelligently recognized this fact. We are still to have 18 battleships, and hundreds of destroyers, cruisers, submarines and plane carriers. We are still to have the strongest surface Navy in our history. But it is wisely decreed that we will build no more battleships for ten years. During that interval we can develop new types. We can give to other weapons their proper place and their relative value in a Three-Plane-Navy. This is the gist of the whole subject. This is not a *one*-idea Navy. This is a *three*-idea Navy. This is not a weak Navy; it is a strong Navy. It is a modern Navy, the kind of a Navy that every loyal American citizen should support.

The Future

So much for the past. Now for the future. We know Naval history up to date. We must now anticipate the conditions of the years to come. Aviation is no longer a theory—it is a living condition. The aeroplane is no longer an untried, untrustworthy, unsafe, unproved flying machine! It is a tried, trustworthy, safe, and invaluable means of travel. It is now a commercial necessity. It will become more necessary and more valuable every day from this time on.

But it is not my place to speak of the commercial value of aviation. It is, however, the duty of every naval officer to study and develop the usefulness of the aeroplane as a weapon. In this we must lead the world, we must not follow.

We must be in front; not behind. Our Navy must be up-to-date, not archaic.

The Bombing Tests

Recent tests have proved, beyond question, that *the aeroplane will be the dominating factor in future wars on land and sea.* Aeroplanes discovered the Iowa within a sea area of 20,000 square miles in less than three hours. As a scout, the aeroplane is supreme. Aeroplanes sank the German ships—a battleship, a cruiser, a destroyer and a submarine with ease. The Joint Board reported that bombs alone could sink any ship that can be designed. The percentage of hits in all these tests was high, remarkably high, when we consider the crude sights and the limited experience in bombing.

Conservatism now seeks to underestimate and belittle these tests. This attitude is as unfortunate and unwise as it is futile. It is claimed that the planes had an advantage in the attack because the targets were anchored and could not fight back. On the contrary, it may be claimed that they would have been sunk or disabled much sooner had the ships been under way with engines and boilers in operation, magazines filled, ammunition, torpedoes, and depth charges around the decks and steering gear vulnerable to attack. General Mitchell's claim that under such circumstances, and with freedom to attack in force and with weapons of his choice he could have sunk or disabled the whole squadron in fifteen minutes is perfectly reasonable. *I witnessed these tests and I believe Mitchell's claim is justifiable.* Moreover, I believe that a foreign fleet that does not command the air above itself constantly night and day *will be destroyed, disabled or driven off, if it comes within one hundred miles of our coast, provided the United States supplies itself with a strong air force.*

Anti-Aircraft Guns

The defense of a fleet by anti-aircraft guns is not possible. The masts, smoke pipes, bridges, radio and other obstructions so interfere with these guns that their field of fire is very small. Moreover they are inaccurate at best. This is especially the case with small ships, rolling and pitching at sea. I am reminded of a story told by Admiral Sims. Two men were out shooting. One of them *stuttered* and the other had *Saint Vitus' dance.* One could talk with difficulty, but his nerves were steady. The other could talk perfectly, but every muscle in his anatomy twitched constantly. The man who stuttered saw a bird, took deliberate and deadly aim, fired, and *missed.* The man with Saint Vitus' dance quickly threw up his gun, the *muzzle wabbling all around in circles,* fired and brought down the bird. His friend exclaimed: W-well; n-no wonder you h-hit him! You a-aimed *EVERYWHERE!* Here we find the

only hope of the anti-aircraft guns. If they are manned by sailors with Saint Vitus' dance, heaven help the airman!

The Night Attack

Now, consider a *night attack on a fleet, or ship,* by aeroplanes. The experiment with the Alabama was illuminating. The attacking planes flew 50 miles, located the Alabama among many ships and bombed her successfully. They were virtually invisible. With their exhaust pipes muffled, we did not hear them. They could have attacked at a very low altitude—near the tops of the masts—if necessary. Against such an attack, a ship is powerless. What could a fleet do if at anchor, or under way, to protect itself from a determined attack by air forces at night? Will somebody answer this question? And suppose the planes use mines and torpedoes besides bombs? In truth, it is appalling to stop and calmly consider the danger to which a fleet at anchor or under way may be subjected by the attack of a well organized, well armed, and well drilled air force, especially at night. Personally, I do not believe that any fleet can successfully operate against such forces, or can survive such attacks. After an experience of more than forty years in training the officers, midshipmen and the enlisted men of the Navy, noting their intelligence, their fearlessness, their devotion to the traditions of the Navy and their loyalty to country, and after viewing the dauntless spirit and skill of Gen. Mitchell and the First Provisional Air Brigade at Langley Field, I am convinced that *no foreign fleet will dare to come within two hundred miles of our shores, if we give these lads the proper weapons and the opportunity to use them. Air forces alone can protect a coast against hostile attack from overseas.*

Armies Cannot Cross the Sea

It is amazing that writers, and so-called experts—even Army and Naval officers—continue to talk about sending armies and fleets to invade or to attack a naval power across the oceans! Can it be done, if that enemy, on the defensive, commands the air? Is such a thing possible? It would appear to be an insane proposition. I wish every man here tonight would read an article by Vice-Admiral Mark Kerr of the British Navy in the Nineteenth Century Magazine for last September. There are American Admirals who fully agree with Admiral Kerr. But they have not felt at liberty to publicly express their opinions on this subject. I believe, however, that they may be encouraged and permitted to do so if the proceedings of the Washington Conference are ratified by the Senate and the people of the United States. Aviation will soon have an inning.

Gentlemen, air forces will discourage or prevent war overseas. The aeroplane is a God-send! It will localize war. It will limit wars to the continents. Intercontinental wars will be impossible, or very infrequent hereafter. Armies cannot again cross the oceans in the face of submarines and air forces. There will be naval wars, but they will be limited. Fleets cannot attack a coast in the future. Air forces will promote the freedom of the sea and protect weak nations.

Bad Weather

Conservatism claims that the aeroplane, the aeroplane carrier, and air forces generally will be rendered ineffective by bad weather, fogs, gales, etc. But all naval operations are similarly affected. Aeroplanes have flown from London to Australia, from New York to Alaska, from San Diego to Panama, across the Atlantic and only the other day Stinson and Bertaud *remained 27 hours in the air in mid-winter during snow storms, and in a gale of wind.* Can a hostile fleet safely approach our shores defying men who do such things in the air? And we must remember that the weather is not always bad. Even admitting that an air force could not always attack in bad weather, would a fleet cross the ocean to attack us, or would we send a fleet to attack overseas with bad weather as our only hope?

Perhaps Army and Naval officers would be less prejudiced against the aeroplane if they could be induced to regard it as a gun and not as a flying machine. *And in truth, it is a gun—the most powerful and effective gun, with the greatest range, the heaviest projectiles, the greatest variety of offensive and explosive agents known in history.* It can carry 4,000 pounds of bombs, large or small, torpedoes, and mines and attack an enemy hundreds of miles distant. Other guns are tied to the beach or to the ship. The aeroplane gun can move to a base anywhere along the coast. *All the planes in the United States can be mobilized against an enemy in a few hours.*

Forts Vs. Aeroplanes

We have considered the helplessness of ships against air attack. How about Forts? Can the forts on our coast, with their 16-inch guns, successfully resist the attack of the 2,000-pound or 4,000-pound bombs? Are they safe at night? Picture such an attack! And compare the usefulness of the guns of a fort with the aeroplane against a hostile fleet, especially at night! The guns of forts and ships are comparatively useless at night. *But it is at night that the air force will get in its deadly work—in comparative safety. It would appear that air forces will be trained and will be used principally to attack at night. If so, it is difficult to see how they can be repelled.*



The Aviation Medal of Merit of the Aero Club of America, presented to Bert Acosta, for establishing the world's speed record; Lieut. Macready for the world's altitude record, and Eddie Stinson and Lloyd Bertaud for the world's endurance record

Limitations of Aeroplanes

It would be unfair not to note certain limitations of the aeroplane as a weapon. Although it carries the heaviest projectiles and the greatest variety of projectiles, it must return to base or to the carrier after it fires its supply of shells, torpedoes or mines—be it one or more. It must have landing fields and bases on shore and it must land on the carrier or in the water alongside and be hoisted on board before it can renew the attack. The problem of air forces operating from the shore is simpler than in operating from the ship. It is for this reason that navies and battleships cannot be scrapped. *The aeroplane carrier bids fair to become the capital ship of the future, but it is not yet fully developed.* We can safely predict, however, that an all-metal plane will be developed that can be handled and hoisted at sea as safely as a life-boat. A navy sea plane was navigated 250 miles in a gale by Comm. Towers and reached the Azores in safety.

The Aeroplane Defends Commerce

Viewing the aeroplane as a gun, it can be used by merchant steamers to protect themselves from attack at sea, provided the arming of merchant ships is not to be forbidden by international agreement. The Navy has developed a catapult which projects the aeroplane from a ship's deck and starts it in its flight. With this device all ships in the Navy and all merchant ships in time of war could be equipped to fight their own battles and protect themselves from enemy cruisers.

Air Power Will Dominate

The more we study this subject the more clearly we see that the Army and Navy must wake up and adjust their ideas to the inevitable. The money available for the military and the naval services must be expended on modern lines to give the best results in offensive and defensive warfare. Forts and battleships must not demand the lion's share. The weapons that can destroy and sink them must take precedence. The victor, not the vanquished, must be rewarded.

A review of this subject justifies the following conclusions:

1. Fleets and forts cannot resist air forces.
2. Armies cannot be sent overseas.
3. A fleet that does not command the air above itself cannot leave the home coast.

4. Aggressive war overseas will be difficult if not impossible.
5. Aeroplanes can attack ships with bombs and torpedoes, and can fence a fleet in with a barrage of mines.
6. A fleet may be completely at the mercy of an air-force attacking at night.
7. The aeroplane is a flying gun of great offensive power—greater than any other gun.
8. Inasmuch as aeroplanes can sink submarines and surface ships, or threaten them with a variety of weapons by day and by night, with as little danger from anti-aircraft guns, it would appear inevitable that sea-power will hereafter be dominated by, or be dependent upon air-power.
9. The next war, on land or on sea, will be won by the nation that commands the air.

General Patrick's Speech

GEN. MASON M. PATRICK (U. S. A.): Mr. Toastmaster, and gentlemen: It is a great pleasure to be one of the representatives of the military air service here tonight to meet with the members of the Aero Club and their guests, and to feel that we are working to a common end, and that the great influence of this great body, individually and collectively, is exerted in behalf of the development of aviation. I suppose there are no people the whole country over who know how far we have fallen behind in this race in the air. And this in spite of the fact that speed is the central characteristic that makes transport by air most desirable, and one that should appeal very much to our people. In spite of the fact that this great country of ours, with its vast distances, lends itself to the development and the use of this method.

Now, there are two reasons for that, why the military air services are insistent that civil aviation shall be developed. First, our pride as Americans is galled when we find ourselves lagging behind. Second, we are concerned that we should have at our disposal in case we are ever again called on to defend ourselves, ever called on to take up arms, we will be in position to give a good account of ourselves. There must be a reserve air force on which the regular service can draw, trained aviators and manufacturers of aeroplanes which with slight changes can be made to serve the purposes of the military service. Unless we can de something to advance this air service, it may be disastrous to our country.

There are three essentials: first, legislation; legislation that will warrant the reliability of the man who flies, and the machine which he conducts. Second, a proper system of airways the country over, with facilities for repair and maintenance. Third, meteorological data, adequate and properly disseminated.

I think we will have these three essentials before long. I look forward to the day, and that soon, when we shall have aeroplanes with constant temperature cabins in which passengers can sit in comfort and fly at great speed. This means great breadth of view on the part of those who undertake it, and it cannot be brought about unless there is a unity of purpose and a national organization that will back it up and see that the United States gets what we ask for.

The air service has to train the little regular service, and the National Guard and the Army's reserves. We have just had a decision which makes it possible for us to take on military aerodromes and civil aircraft, and we will be able to provide facilities for their refitting and their repairs so they may proceed on their journey.

That is one step.

I go as far as the Secretary of War when he says that something must be done to encourage aviation. This can be by indirect aid, and if that does not produce the direct results, then we must go after it in another way. I speak for the Army air service. It has done considerable work since your last annual dinner. It is scarcely necessary for me to call your attention to the results of the bombing tests carried out in 1921 off the Virginia Capes, for they have given more thought to military men—and I include naval men under that designation—than anything else since gun powder was introduced. For the success of this I give all credit to Gen. Mitchell, for with his enthusiasm and energy and knowledge he was able to bring these results about which have startled the world.

There was gathered at Langley Field a group of men, and when the time came they did not fail to realize the effect it had on naval thought, and it has been expressed already much better than I could possibly express it by Admiral Fullam.

We feel as he does, that the air force can make us safe from aggression, no matter where it comes from; and that no fleet, no matter what its size, can imperil our shores; and it is impossible for any enemy fleet to bring with it an air force to enable it to work destruction in our land.

The Army has sent a bi-motor plane higher than ever before. This enabled Shroeder and Macready to rise to heights beyond any which living man had heretofore penetrated. In addition, I am told we have eliminated the caterpillar and the bollweevil, and I suspect that in the course of time in future wars you will find that with aeroplanes we are keeping the cooties off the boys. By distributing the reserves of the country and bringing the people closer together, the air craft are a means for preserving peace just as if aggression should come, they are means for resisting the aggression. I look into the future and see in the air service of this country new fields in which it can perform. I see our borders, north, south, east and west, linked by air-ways properly marked and lighted so that it will never be out of sight of means to identify where it is when it is in the air. This means safety; this means greater prosperity, and it means a greater United States.

Capt. Rickenbacker's Speech

CAPT. RICKENBACKER: Interest in civilian aviation is increasing rapidly among automotive and transportation engineers.

The various branches of the Government are taking it up in a serious way.

The presence here tonight of the Chiefs of the Army, Navy and Marine Corps flying services, and of leading engineers and executives in the automotive world is highly significant of the recognition being accorded the science of aeronautics.

For since the war, surmounting many of the obstacles which followed in the wake of the conflict such as hard times, business depression and general lack of confidence, or perhaps it would be better to say industrial unrest, aviation has managed to hold its own with other means of transport; in fact, it has done better than that, for isn't it conceded that we are farther along in aerial transport today than we were when the last annual dinner of the Aero Club of America was held in 1919—that year of social, industrial and economic problems in which there was no concrete promise for the sciences, other than a promise of hard times and bitter uphill struggle ahead.

We *have* progressed in aeronautics.

We, all of us, now understand the importance of the flying machine as a means of national defense. It is recognized as our third arm, and many of us believe that it is our most important arm—one which will increase rapidly in relative importance.

Civilian Flying Increased 20 Percent in 1921

As for civilian flying. It increased 20 percent in 1921 over the preceding year, according to statistics compiled by the Aeronautical Chamber of Commerce, which made a survey of the progress of flying among civilians in this country.

We have no official Government machinery for checking up on civilian flying by the Aeronautical Chamber of Commerce estimates that in 1921 approximately 1200 aeroplanes were operated by civilians in the United States.

These estimates place the total flying at 6,500,000 miles and the aggregate number of passengers carried during the year, 275,000.

The history of the development of transportation facilities presents a progressive improvement in type. The latest type to reach a high state of development is the automobile. This development has been reached in twenty years of the most intensive activity on the part of the best engineers and executives in this and other countries of the world. The legitimate successor, or the heir apparent to this rich heritage in the automotive field is the aircraft industry. Just as the automobile people twenty years ago commandeered the experience of the coach and locomotive builders and everything that had gone before, so the aeroplane engineers in their turn, with a full sense of appreciation and gratitude, commandeered all of the accumulated experience of the automotive world. Now that aeroplane design has passed beyond the stress of the war period and aeronautical engineers can further appreciate and differentiate this knowledge with a clearer perception of the difference between traction and flight, and with the greater breadth of vision that has come with the continued studies of the problem, all the automotive and aeronautical world will be drawn into a closer fraternity of parallel interst and mutual help. There is much that the automobile industry can and should profit from the special work of the aeronautical engineer by lightening the superstructure of motor cars.

Aviation Is Now a Practical Art

Bearing this in mind, we must consider aviation as a practical art.

Our Air Mail Service, three and a half years old, is one of the best examples of efficiency in the air. I am informed that it has a record of 89 percent efficiency since its organization in

May, 1918. It started out with a few army training machines carrying two or three bags of mail between New York and Washington. Today it carries the mail on regular schedule daily, and supplements train service all the way from New York to San Francisco. At 14 of the principal stations wireless equipment has been installed and is now operating, serving to perfect the communication system which all pilots need to insure successful flying cross-country. Provided with advance information concerning the weather, ceiling and condition of emergency fields along his line of flight, the air mail pilot has found it possible to bring the mails from the Pacific to the Atlantic within 48 hours elapsed time.

During the last year, private individuals and companies have literally flown all over the country. Every river, lake and coastline has been traversed by commercial flying boats. Our overland machines have hopped off in all kinds of weather, and, scorning mountains, valleys and wilderness, have criss-crossed the country at varying speeds of a hundred miles an hour or so, on every conceivable kind of mission—from carrying freight to hunting moonshiners.

We have here tonight many of the gentlemen who, by their ability and unselfish devotion to the big idea, have placed America well in the lead in sporting aviation. The public has read thousands of columns about their daring exploits in the air—invariably conquering and overcoming all obstacles and successfully accomplishing their mission.

Public Confidence in Aircraft Necessary

All this has worked wonders for civilian aviation. It has given the public the confidence which it has sadly lacked—a confidence which it still lacks to a lesser degree, it is true, but the public confidence remains to be secured or won, nevertheless. And that is what we all are working for. That is one great result of gatherings such as this. They show the people that there are persons in large numbers who have faith in the flying machine.

Then there are the people who are doing the actual flying. They are converting the public.

There are more than 125 commercial aerial transport organizations in this country today. Some of them, it is true, are operating on a shoe string. Others are highly organized and supported by private subscription in expanding their service wherever conditions warrant

125 Organizations Operating in United States

These, we will say, 125 companies, are operating at least half of all the planes in use in this country, that is, among civilians. The other half are owned by persons using them for private purposes, or by the so-called gypsy pilot, who moves about the countryside much as the itinerant minstrel of old.

And the song of the gypsy pilot is the song of the air—he may earn a living or he may not, but he earns the gratitude of the American public just as the preacher and the schoolmaster a century ago earned a nation's gratitude by tramping from place to place, from town to town, moulding public opinion and stimulating thought and education among the great mass of people who live outside the centers of population.

For this is a broad country. The field is unlimited. The uses to which we have put the aeroplane are few compared to the uses to which we shall put it—after people learn to use it for all it's worth.

So, it will be seen, we are making progress in the air.

Now for some of the problems which we here tonight must face in developing commercial and civilian aviation.

Civilian Aviation Is the Great Defense Reserve

First of all, we must bear continually in mind that in dealing with civil aviation we also are dealing with our aeronautical reserve, the great third arm of our national defense. They are one and the same thing, civil aviation and national defense.

I have been a pilot. I believe I know the pilot and I hope that I do not underestimate his value to aviation. The aviator today is a being set apart from others. It is not unusual to hear him termed a god among men, and so on, with all the flowery encomiums that the great hero-loving public loves to shower on a person who qualifies for something that it does not quite understand.

We must not forget the pilot. But in our attention to him let us not forget the various agencies and persons that make it possible for the pilot to fly.

One hears very little about the mechanic, the designer, the engineer. One hears nothing about the executives who manage to provide enough money to meet their pay-rolls, and thereby keep the designer, engineer and the artisan on their respective jobs, experimenting, assembling, turning out machines that fly, planes that fly safely, and year by year with improvement over the machines that were made before.

Our Civilian Industry Must Be Maintained

We must maintain that organization with every means at our command. For it is the civilian aviation aeronautical industry which will provide our aircraft and develop and perfect it. We must maintain it not only for civilian purposes but for military emergencies.

We could do nothing in war without it. We would be far behind an enemy did we not possess an aircraft building industry capable of producing machines in performance and quantity the equal of any other nation. I say any other nation in all sincerity, because once at war we would find that our enemy would go into every market of the world for the best in planes and equipment.

We need an aircraft industry second to none. If we don't have it we are passing up our chief insurance against war and our chief protection if war should come.

And, mind you, that great important truth throws the aircraft industry directly into the arms of the Government. By that I do not mean to suggest or bid for subsidies; though it is a well known fact that every nation on earth is subsidizing its aircraft industry.

The Government Must Support Civil Aviation in Two Ways

Our Government must take cognizance of the need for this industry.

It must support it, legitimately in every conceivable way; and I am strongly of the opinion that there are two principal methods for the Government to act in this matter; and *act now!*

Build Government Aircraft in Civilian Plants

1. By adopting a policy wihch will take aircraft construction out of the arsenals. Remove the construction of aircraft from Government owned and Government operated factories and place that work where it will serve to maintain a reserve industry, helping to nourish it until by the increased use of civilian machines, our plants and factories, and our engineering establishments shall become self-supporting. It will be cheaper in the long run, and without added cost to the Government at present or in the future. The civilian aircraft builder can produce Government planes, designs and engineering facilities and equipment as reasonably, in fact, more economically than the Government. And that is the truth, borne out by figures which are available to every person who cares to investigate the truth of the statement.

Pass the Wadsworth-Hicks Bill Now in Congress

2. Then also, the Government must provide us with aerial law. Today aviation is technically an outlaw institution. We have no laws to protect it or control it. One can fly anything, anywhere, with nothing but his own judgment to guide him. The reckless pilot, the fool stunt flier, the conscienceless promoter of fake aerial enterprises—these people can claim to do anything that the best of us can do in the air—and get away with it. The man of conscience and desiring to abide by the law, protecting himself, his passengers and the property and persons of others on the ground, finds himself up against it because he has no laws to guide him, and no law to protect him.

We need aerial law, federal laws, telling us what we can and cannot do—licensing our planes and our pilots when they are proved airworthy and reasonably safe. We want some standing before the law. Give the men of the air an even break.

In view of this I call your attention to the Wadsworth-Hicks Bill, now before Committees of both Houses in Congress. It provides for a Bureau of Civil Aviation in the Department of Commerce, which shall license pilot and plane, administer the laws and supervise the development of civil flying. This bill should be passed immediately, as it embodies most comprehensive plans for eliminating many of the problems with which aviation is confronted.

Protect our pilots and give our aviation industry an even chance for its existence and we shall keep pace with other nations in the air.

Rear Admiral William A. Moffett, in charge of Naval Aviation, in the course of an admirable speech, endorsed heartily the sentiments of Admiral Fullam and Major General Patrick, and assured his auditors that the Bureau of Aeronautics of the Navy would co-operate in every way in the good work of the new club.

The Hon. Fred C. Hicks, member of Congress, and an ardent supporter of aeronautics, delivered a rousing speech, which was most cordially received. He assured his hearers that he would do everything within his power to put the United States in the position of world leadership in aeronautics, which was our prior right.

The motion pictures of the bombing experiments and landing



Grover C. Loening, winner of the Collier and Wright Trophies

of aeroplanes on the deck of vessels, which were described by Admiral Moffett and Capt. St. Clair Streett, were greatly enjoyed.

Following is a list of the guests present:

Gaetan Ajello, H. W. Alden, J. H. Anderson, F. Arcier, Vincent Astor.

C. R. Baines, E. H. Ballard, W. Barling, Lt. R. S. Barnaby, Luther K. Bell, W. N. Bennett, Lloyd Bertaud, S. R. Bertron, L. W. Bettiger, Jack Binns, Cortlandt Field Bishop, Gutzon Borglum, S. S. Bradley, Caleb S. Bragg and Guests, Sidney Brewster, George Royce Brown, H. R. Burt, Charles T. Bush, Jesse Butcher.

John R. Cautley, H. B. Childs, V. E. Clark, James Clausen, Howard E. Coffin, J. B. Coleman, C. B. Coombs, Capt. C. W. Connell, John W. Cox, Henry M. Crane, Hon. Benedict Crowell.

F. Trubee Davison, Charles H. Day, Capt. de Lavergne, Thomas Dixon, Ladislas D'Orcy, Capt. J. O. Donaldson, Nelson Doubleday, J. Dunn, Pierre S. du Pont.

T. J. Egan, Cleburne Eberhardt, Jr., Charles Jerome Edwards.

Snowden A. Fahnestock, Paul Fitzpatrick, A. G. Flachbar, A. H. Flint, A. Holland Forbes, Rear Admiral W. F. Fullam, E. F. Gallaudet, Charles W. Gardner, Dr. H. R. Gilhuly, W. L. Gilmore, Major Charles J. Glidden, Robert Graves, Harry Gray, Edwin Guggenheim, Harry Guggenheim, Lt. Col. A. Guidoni.

Capt. George W. Hamilton, Paul H. Hammond, J. L. Harkness, Edwin Harris, E. M. Haslam, Arthur C. Heldman, Brig. Gen. Nelson H. Henry, Walter J. Hewlett, Hon. Fred C. Hicks, Frank Hill, A. B. Hilton.

Frances T. Homer, L. S. Horner, George H. Houston, Richard F. Hoyt, Murray Hulbert, Miller R. Hutchinson.

G. Sumner Ireland.



Major General Mason M. Patrick, Head of the Army Air Service

J. W. Johnson, Joseph W. Jones.

Charles Keel, W. Wallace Kellett, E. A. Kelly, Col. F. R. Kelly, Gen. W. L. Kenley, Charles F. Kettering, C. M. Keys and guests, C. Roy Keys, Alexander Klemin, Theodore Knight, V. W. Kliesrath, Major Arnold Krogstad.

F. H. La Guardia, Gordon Lamont, John D. Larkin, Jr., William A. Larned, Harry Larsen, John M. Larsen, Edward J. Lavino, Charles L. Lawrence, W. B. Lebherz, Thomas J. Lewis, Earl J. Lomen, A. P. Loening, Grover C. Loening, Israel Ludlow.



The Genial Toastmaster Kettering

George Margolin, E. W. Marland, Howard Marmon, Walter Marmon, Samuel S. Mather, Burt McConnell, Donald McIlheny, Hugh D. McKay, Capt. McLaughlin, George J. Mead, G. Mejia, William Metzger, Howard L. Mingos, Rear Admiral W. A. Moffett, Ora J. Mulford, B. H. Mulvihill, T. E. Myers.

C. W. Nash, L. S. Neushal, George Newbold, Sidney Newborg, William W. Niles, Arthur Nutt.

S. O. Ochs, Everiste A. Orteig, Jules Orteig and guests, Raymond Orteig.

Arthur W. Page, Herbert Partridge, Major General Mason M. Patrick.

H. C. Pearson, C. G. Peterson, Stephen Philbin, T. S. P. Pierson, Roger Poor, Harold L. Pope, Augustus Post, George Post, Otto Praeger, J. L. Pratt, E. F. Price, George M. Pynchon.

F. B. Rentschler, Capt. Eddie Rickenbacker, Major James G. Rider, J. K. Robinson, Jr., William A. Rockefeller, John M. Rogers, F. Root and guest, Major D. E. Rowland, Lieut. John Roullot, Frank H. Russell.

Austin L. Sands, Howard A. Scholle, W. H. Schoonmaker, Alexander Seversky, Howard Sheaff, George D. Shallenberger, Col. E. H. Shaughnessy, E. Sikorsky, A. P. Sloan, Major Lorillard Spencer, Lawrence Sperry, Arthur N. Starin, E. F. Stewart, H. C. Storck, Eddie Stinson, William B. Stout, Capt. St. Clair Streett, Com. Strong, Donald O. Stuart, Father John Sullivan, Norman S. Swan, Fabian Swanson.

H. E. Talbott, Jr., B. D. Thomas, Edwin L. Thomas, W. D. Tipton.

Raymond B. Uber, Rex Uden.

Jesse G. Vincent, Joseph Van Vleck, Jr., Harry Vissering.

Sidney Waldon, P. N. Walters, G. Douglas Wardrop, Raymond Ware, George Henry Warren, Jr., Richard Watkins, Major W. R. Weaver, C. W. Webster, George S. Wheat, E. C. Whitbeck, W. S. Whittaker, Rushmore Wood, J. W. Woodrow, Capt. Burdette Wright, Robert Wright.

THE NEW FOUR-FOOT WIND TUNNEL AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

By WILLIAM H. MILLER and JOHN R. MARKHAM

DURING the month of August of the current year, the construction of two new wind tunnels was begun at the Massachusetts Institute of Technology; one having the experimental chamber four feet in diameter, the other a diameter of seven and one-half feet. The smaller of these tunnels, the four-foot, is now in operation. It replaces the four-foot N.P.L. type tunnel constructed at the Institute in 1913 under the supervision of Commander J. C. Hunsaker.

The present tunnel was designed and constructed under the supervision of Professor Edward P. Warner of the department of Aeronautical Engineering, with the assistance of the writers.

The four-foot wind tunnel (as well as the larger one) is of venturi type with an overall length of 42 feet, thus having a length-diameter ratio of 10.5. It is of circular cross section throughout. The intake bell (or entrance cone) has a length of 11 ft. 6 ins. with a mouth diameter of 9 ft. 6 ins. Its surface is generated by revolving an ellipse of semi-minor and semi-major axes, 2 ft. 9 ins. and 11 ft. 6 ins. respectively, about the tunnel axis.

The throat comprising the experimental chamber is of cylindrical form, 4 ft. in diameter and 6 feet long.

The exit cone is of the straight type having a length of 24 ft. 6 ins. and a diameter of 7 ft. 9¾ ins. at the large end. The cone is faired to the experimental chamber by giving the surface near the experimental chamber a slight curvature. The vertex angle is approximately 9°. The complete wind tunnel is supported on steel struts of angle iron attached to the footing of the old tunnel. A special type of bracing is used which is designed to relieve the tunnel as much as possible of longitudinal tension and compression. The complete tube was built on the ground in three sections; intake bell, experimental chamber and exit cone. The frame work of the intake bell and exit cone, alike, consists of built-up circular rings notched to carry 32 longitudinal slats. The rings are constructed of ⅞ in. x 8 in. whitewood stock. The exit cone slats are straight 2½ in. x ⅞ in. whitewood, while the curved slats of the entrance cone are twice the thickness of those in the exit cone and are laminated. The entrance cone is lined with a high grade of plaster of thickness 1½ in., reinforced with heavy steel lath. A revolving template was used in the final moulding of the inner surface. The plaster was backed up on the outside and troweled to a smooth finish between slats.

The exit cone is lined with 3/32 in. three-ply birch veneer which is nailed to both slats and rings.

As it is necessary to have the experimental chamber quite rigid and capable of carrying considerable load, it was built up of ⅞ in. x 1½ in. lap joint whitewood stock nailed to circular rings. The experimental chamber has a large glass door on the side and a glass window on the top for aligning models and apparatus. There is also a large removable bulkhead in the floor.

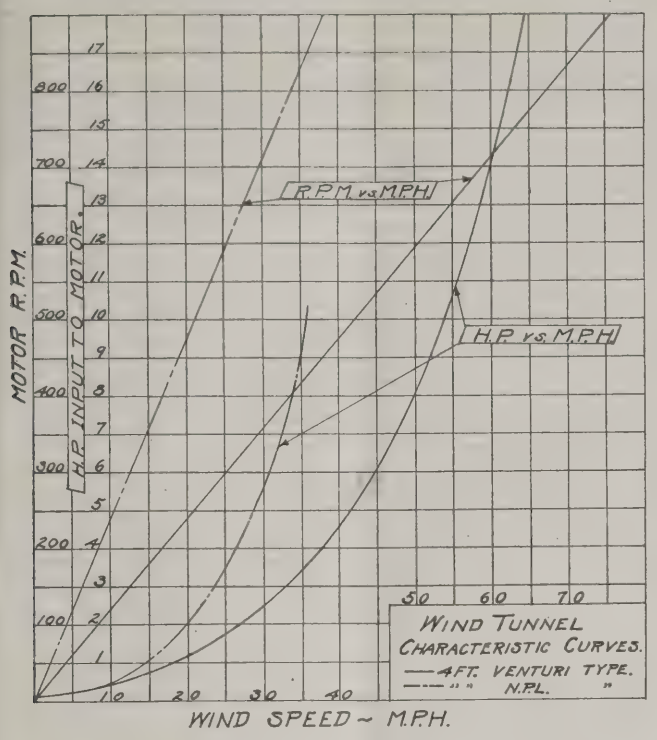
The slightly remodeled honeycomb of the old tunnel is in



Side view M. I. T. 4 ft. Wind Tunnel



Exit cone end M. I. T. 4 ft. Wind Tunnel



use at present. It is built up of circular tubes of thin-gaged sheet metal, three inches in diameter and eighteen inches long; and is placed in the forward end of the experimental chamber 37 inches from the balance spindle. Although this distance between honeycomb and model is considerably less than is usually used, the flow is unusually steady and the agreement between results of the old and new tunnels remarkably close. The chief disadvantage of such a location of the honeycomb, however, is in its poor economy from a standpoint of power. It appears that in the tunnels of the venturi type the efficiency can be substantially improved by using a honeycomb of larger overall circumference located near the mouth of the entrance cone.

The original power equipment of the old tunnel has been retained. A 12 K.W. direct-current generator driven by a 15 H.P. induction motor supplies current to a 10 H.P. direct-current motor driving the propeller through a chain belt. A new propeller having a diameter of 7½ feet and of variable pitch has been installed.

The power curves for the old and new tunnels are shown in the accompanying graph. Despite the fact that the motor is somewhat heavily overloaded, it is possible to obtain a maximum speed of 65 m.p.h. A speed of 60 m.p.h. it is observed can be obtained with 40% overload of the motor.

The efficiency of the motor-fan-tube unit is given by*

$$\eta = \frac{\text{K. E.}}{\text{K. E.} + E_s}$$



Entrance cone M. I. T. 4 ft. Wind Tunnel

where K. E. is the kinetic energy in the throat and E_s is the energy supplied from external sources. Using horsepower units

$$\text{K. E.} = \tfrac{1}{2} \times \rho/g \times \frac{AV^3}{550}$$

where A is the cross section area and V the velocity in the throat in ft. per second. The mass density ρ/g is equal to .00237 for standard air. E_s is the horsepower input to the motor. The normal velocities in the old and new tunnels are respectively 30 and 60 m.p.h. The respective overall efficiencies are therefore 32.5% and 56.7%, as can be easily verified by means of the power curves given.

The original N.P.L. type aerodynamic balance is in use at present. A new balance, however, is under construction. The wind speed is obtained by means of a Krell manometer connected to a static opening in the throat. The manometer was calibrated in the usual manner, by means of a pitot tube and Chattock gage.**

* This definition of the overall efficiency of a wind tunnel is due to William H. Miller, graduate assistant in Aeronautical Engineering.

** "The Wind Tunnel of the Massachusetts Institute of Technology," by J. C. Hunsaker, in "Reports on Wind Tunnel Experiments in Aerodynamics," Smithsonian Miscellaneous Collections, Vol. 62, No. 4, pages 1-15.

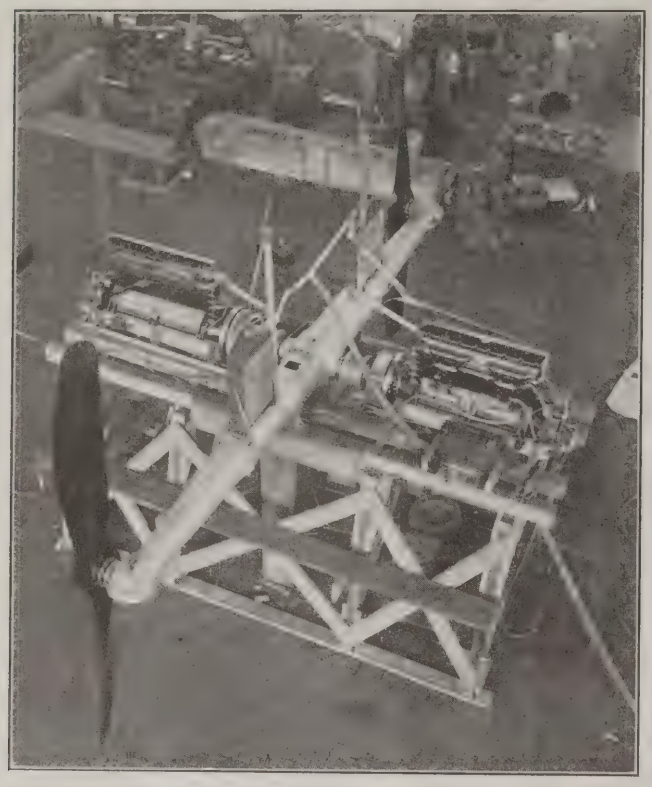
GOODYEAR GEAR-DRIVEN AIRSHIP

By H. T. KRAFT

Chief Aero Engr. the Goodyear Tire & Rubber Co.

THE envelope of the new Military Airship being built for the U. S. Army is of the Pony Blimp shape, having an aspect ratio of 3.6 to 1. While there has been considerable question as to the head resistance of a large diameter ship, the entire absence of tail droop and the maintenance of a perfect stream-lined shape on non-rigid ships, are items which are usually overlooked, and are important factors in reduction of resistance of an envelope, apart from the fact that there is a tremendous reduction in skin friction due to the short length of the hull. From a dynamic standpoint, ships of a short aspect ratio have been considered somewhat unstable, but there again, the high static stability due to the low center of weights, of course, is not represented in wind tunnel tests on the model of the envelope itself, and a ship of this type should be equally as stable in view of this condition as any airship of this capacity built in the past. The envelope and the car are faired together with an elastic fabric immediately below the envelope, making the entire ship a well streamlined body.

There is a tremendous saving in surface weights of the envelope proper, in this particular unit reducing our weights over 1,000 pounds. With that, of course, goes the reduction in diffusion, which should be about one-sixth less than ships built in the past of the same capacity. There should be no surging of the ballonet, due to its particular design, wherein



Gear Arrangement of Goodyear Airship

the base line attachment to the envelope is greater than its lateral area, it being impossible for the ballonet to travel beyond this fore and aft base attachment point.

The car is of the enclosed type, with two longitudinal sills 18 inches deep which constitute the backbone or principal strengthening members of the structure. The balance of the car is simply a shell, housing the crew, and permitting a closed car to be built of approximately the same weight as any open type of car constructed in the past. While the development of airships in the past has necessitated the adoption of various instruments, they were usually attached as an afterthought in a rather makeshift arrangement, but before attempting the construction of this unit, we formulated plans so that the control of the airship would be entirely unified. The control board carries every instrument that is required for successful lighter-than-air navigation, and is set in the car in such a manner as to permit all instruments to have the highest degree of accessibility. The pilot controls the entire transmission, clutches, reverse device, etc., from the navigating cabin. The engineer is located in a separate cabin to the rear of the car, with an instrument board for reading all pressures and temperatures of the motors and transmission assembly. The mufflers are of the dual type, in which a part of the air which is delivered to the ballonet is circulated around the exhaust chamber and then into the exhaust itself, to assist in muffling the exhaust noises.

Water ballast is carried in the floor of the car immediately below the navigating cabin, wherin a dial is located to indicate the amount of water available for ballast. The fuel tanks are located in the rear part of the navigating cabin, in two 160-gallon tanks, so constructed as to permit them to be used as sleeping cots in case of long flights. Provisions are made for a crew of seven.

It will be noted that all suspension cables run to the floor of the car, thus permitting veneer sides of 3/32" thickness to be used. As all loads are concentrated at the floor line, the surge of the car while in flight is resisted by two lateral cables and four longitudinal cables attached to the center bulkhead. This, in addition to martingales which are also attached to the floor line, has proven very successful in overcoming the surging fore and aft such as is usually experienced when a car is hung too far away from the hull. The disposable load is located directly under the center of volume of the ballonet, thereby permitting a single ballonet to be used, without any possibility of getting out of trim, irrespective of the loads carried within the car.

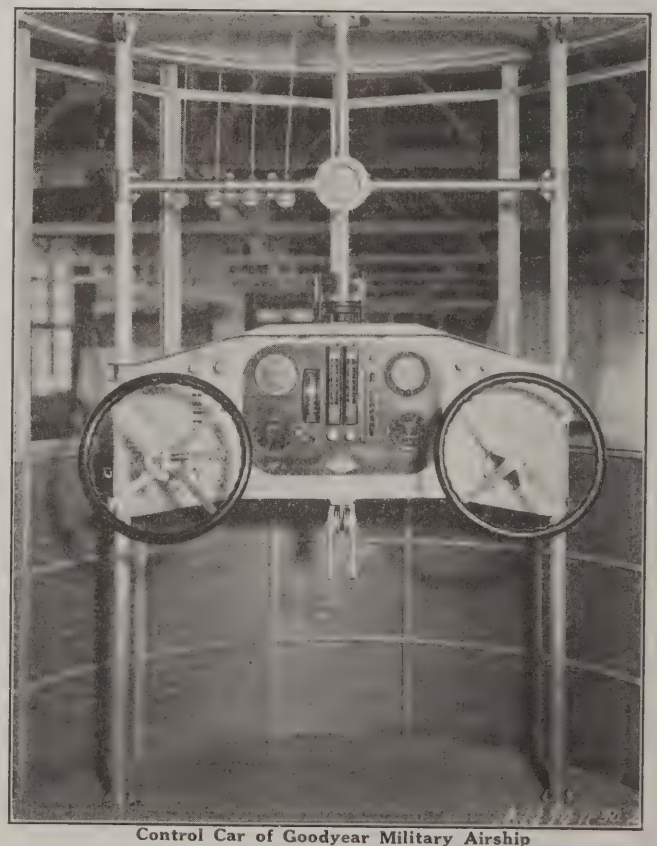
In going over all the data we could secure on transmissions built in the past, we well realized the problem that confronted us as there had been so many failures along this line. The outstanding difficulties that were experienced with transmissions built in the past were heating up of the oil and excessive vibrations due to torsional reactions, also the transmission getting out of step with the motors, causing excessive gear noise. It, of course, was our thought to design a transmission that would be entirely free from these defects. In closely scrutinizing the construction of other gear drives, we found that the principal defects were the entire lack of unit construction, wherein the designer depended upon struts or other connections to the car or fuselage, and in the case of aeroplanes, attachments to the wing struts, which, of course, made it quite obvious that trouble would be encountered.

In laying our plans for the Goodyear transmission, our first thought was to make the entire assembly one integral unit, wherein the clutches, couplings, gears, shafts and propeller gear housing would be built together in the most direct manner. It was largely on this basis that the success of the transmission was assured. We next analyzed the gears of several different types of transmission and found that the tooth profile was bad, and in view of using straight bevel, trouble was experienced in perfect citting of the teeth, which resulted in excessive gear noises.

The Goodyear transmission was designed with spiral bevel gears in which considerable experience was available, in view of their popular use in the automobile industry. The teeth were 4-5 pitch 30 degrees tooth angle, and were made by the Gleason Gear Works of Rochester, N. Y. We found that in making the preliminary test run on a dynamometer that there was an entire absence of gear hum, and while this dynamometer test forced us to allow two gears to idle in the case, we experienced very little heating up. To get an absolute percentage of efficiency of this unit, in the airship itself, we constructed a large wooden stand upon which were mounted two Aeromarine 135 h.p. type U-6-D motors, connected thereto being two clutches of the multiple disc type, manufactured by the Twin Disc Clutch Company of Racine, Wisconsin. Couplings between the clutches and the transmission were of the fiexible type so designed as to take some degree of misalignment and angularity.

While theoretically this unit is in perfect alignment, the couplings were inserted to absorb any misalignment that might occur due to the weaving of the car proper. The transmission tube which is one complete unit is held on the cross sills by eight bolts at the outer edge of the car. A test load of 1,000 lbs. was hung on the propeller tip with a deflection of only 0.098. We were thus assured that a propeller which weighs

(*Concluded of page* 479)



Control Car of Goodyear Military Airship

NAVAL and MILITARY AERONAUTICS

Booming Army Aviation

To interest young men in the Air Service of the United States Army, Lieut. E. H. Barksdale with an aeroplane from Mitchel Field, Mineola, "bombed" the lower part of New York recently with pamphlets containing information concerning Uncle Sam's aviation forces. Lieut. Barksdale was accompanied by an observer.

The aeroplane, flying at a height of 3,000 feet, circled the Woolworth, Singer, Pulitzer and other buildings. It then headed north and circled Grant's Tomb. Crowds scrambled for the pamphlets as they landed. Other flights will be made.

Rockaway Naval Station

Application of the Navy Department for a grant by New York city to the Federal Government of about 150 acres of Jacob A. Riis Park at Rockaway Point for use as an air station was formally withdrawn at a meeting of the Sinking Fund Commission. Opposition to the project had mustered a formidable gathering to fight it.

The city agreed to permit the navy to continue the use of some ninety-five acres of the ground it now occupies for six months. If the Department wants the land longer it may renew the application. Murray Hulbert, Aldermanic President, who had favored the project when he was Dock Commissioner, made the suggestion that the application be withdrawn. He said he had been surprised to learn in Washington a few weeks ago that the Naval Committee of neither the House nor the Senate was aware of the project.

The Navy Catapult

In addition to carrying aircraft on special vessels known as aircraft carriers, it is anticipated that fighting and spotting planes may in future be carried on battleships and cruisers, although it is clearly impossible to provide these ships with the flush deck as in the case of the carriers. To permit the launching of aeroplanes from a battleship or other war vessel, the catapult has been resorted to, and a special type of catapult has been developed at the Philadelphia Navy Yard which has been designated a turntable catapult because the catapult mechanism proper is mounted on a turntable so that it can be pointed into the wind when launching a plane. One catapult of this type could be installed on every battleship and could launch when needed a fighting aeroplane, so that a fleet of battleships would be able upon the approach of hostile bombing aeroplanes to send into the air instantly a large number of fighting planes to shoot them down before the bombing attack could be developed. This is the real answer to the threat of the bombing plane, which was demonstrated in so spectacular a manner by the recent bombing from the air of the ex-German warships.

In the bombing attacks of these ex-German warships it was shown that bombs dropped from the air could do material damage to warships which did not defend themselves. Obviously a warship can defend itself by anti-aircraft gunfire, but better by attack in the air. The weapons of offense and defense in the history of naval warfare have always developed step by step, and the development of the heavy bombing aeroplane is being met by this development of a catapult which will shoot fast combat planes from the decks of battleships into the air to repel bombing attacks.

The catapult of this particular type is new, but the elements are the result of Navy catapult development initiated in 1911 by Captain Washington I. Chambers, at that time in charge of Naval Aviation experiments. The first flight was made November 12, 1912, by Commander, then Lieutenant, T. G. Ellyson in a Curtiss seaplane from a catapult. This early catapult was highly experimental. and while the first flights were successful, the device was not entirely satisfactory. The matter was resumed in 1915, when the development of Naval seaplanes had proceeded to such a point that it was clear to the Navy it would be desirable to take aircraft to sea. A new design of catapult, based on experience with the first one, was installed on the stern of the armored cruiser "North Carolina," and successful flights were made. The "North Carolina" installation proved so reliable that similar catapults were installed on the armored cruisers "Seattle" and "Huntington," and during the early winter of 1916 successful flights were made from these cruisers. At the time the United States entered the war the principal Naval effort was anti-submarine in its object and the convoy of shipping. Aircraft were not needed aboard these cruisers for this purpose, and the catapults were removed. After the armistice the catapult problem was again taken up and a catapult, similar to the "North Carolina" design, which had been in use at Pensacola for training aviators while mounted on a coal barge, was brought to Washington and further tests and investigations made. The result of this investigation led to the design of the present turntable type of catapult, which has now been completed at the Philadelphia Navy Yard and mounted on the water front for practical testing with aircraft.

The old catapults, such as were used on the "North Carolina," consisted of a track along which a carriage was propelled by a compressed air cylinder. The aeroplane was mounted on this carriage, and as the carriage speeded up it released the aeroplane at the end of its run, allowing it to fly into the air. The track for this catapult was mounted along the center-line of the ship, and since it was necessary to launch the aeroplane direct into the relative wind, it was necessary for the ship to set herself on such a course that the wind blew in the direction of the catapult track. This maneuver, while entirely feasible, necessitated the ship turning out of formation, or heading upon some course which might prove very disadvantageous. For a battleship it is considered impossible to require the ship to leave formation and to head upon a course which is possibly of great tactical disadvantage only for the purpose of launching a plane. These considerations led to the development of the turntable catapult, which permits the ship to proceed upon its usual course in formation while the catapult is trained like a turret into the relative wind.

The turntable catapult consists of a bridge-like structure mounted on a turntable upon which there is the usual car which carries the aeroplane, and this car is propelled by compressed air. Frequent tests have demonstrated that it is possible to launch by such a mechanism any of the types of aeroplane or seaplane which would be carried upon a battleship.

The problem of launching an aeroplane in a short run by means of the catapult depends upon several factors. The first and primary one is, of course, that at the end of the run the catapult should have given the plane a speed such that when the plane is released from the car the wings will lift it into the air and flight has begun. This requires that the launching velocity shall be *somewhat in excess of the minimum flying speed of the plane.* Second, it is necessary while the plane is being brought up to this flying speed that the plane be held securely to the launching carriage in order that it will not leave the track too soon. Finally, it is necessary that the acceleration of launching shall not be so great or so violent as to injure the pilot, who must ride in the plane and preserve all his senses alert in order to take charge as soon as he is released at the end of the run.

The development of a successful catapult to accomplish these desired things is believed to mark an important step in providing our fleet with aircraft, and with these turntable catapults, which are relatively small and compact, it is possible to provide the individual vessels of the fleet either with aeroplanes which can be launched from catapults when desired, but which will land upon an aircraft carrier when their mission is completed or, alternatively, the warship may carry seaplanes which can be launched from the catapult in a similar manner, but which will land upon the surface of the sea and be hoisted aboard like a ship's boat. Until such time as the Navy is provided with a suitable number of aircraft carriers it will be necessary to use seaplanes for work with the fleet. Under many conditions the seaplane in its present state of development is entirely practical, although in very rough weather a landing upon the sea is likely to mean the damage if not the loss of the seaplane, although it is to be expected that the aviator can be rescued. The conditions of the weather, however, are not believed to offer any inconvenience to launching by means of the catapult, and in time of war the commander-in-chief will launch his planes in the air where they may accomplish their mission regardless of whether or not the planes may be salvaged intact upon their landing.—*Scientific American.*

FOREIGN NEWS

The French Air Routes

Some very interesting figures relating to the progress made by the French aerial routes have been issued by the French Under-Secretariat of State for Posts and Telegraphs. These figures disclose that, taking the twelve months from October, 1920, to October, 1921, the mail traffic on the London-Paris route has steadily diminished in volume. In October of last year 3,005 postal packets were carried, while in the corresponding month of 1921 this number had fallen to 1,923. It may be remarked that it is quite possible that a good deal of this decrease is due to the fact that regular British lines are running and are obtaining their share of the mail traffic. Nevertheless, the figures are somewhat curious, the more so as we find the same conditions affecting other French lines, which are not subject to outside competition. The Paris-Brussels service shows an astonishing falling-off, only 71 letters being carried last October, as against 621 in the corresponding month of 1920. Paris-Amsterdam shows a decrease from 176 in May last to 35 in October, while the figures of Paris-Strasburg fell from 115 letters in October, 1920, to 64 in October last.

On the other side of the picture, we find that Paris-Prague rose from 138 packets of mail in 1920 to 863 in October of this year. The Paris-Warsaw route, opened in May last, carried 344 letters in that month against 877 in October. A really wonderful result is shown by the route Toulouse-Casablanca. In October of last year this service carried, out and home, 24,349 postal packets, and in the corresponding month of 1921 this total had increased to 40,607. During the whole year no fewer than 306,181 letters were carried by this service, Paris-London coming next with 28,534.

The deduction to be drawn from these figures seems to be that the business community does not attach a great deal of importance to the saving of a few hours on the shorter aerial routes, but that where the saving of time amounts to days, as it does in the case of the Toulouse-Casablanca route (by which five days are saved in comparison with train and steamer), there is a rush to take advantage of the facilities afforded by the aerial post. The figures are more than a little interesting, and can, we think, be studied with advantage by our own postal authorities, who seem dubious as to the advantage or otherwise of using aerial communications to the more distant parts of the Empire. The way they appeal to us is that they prove that the longer the distance over which aerial conveyance is used the more rapid the growth of the traffic and the more successful the enterprise must be.—*Flight.*

Commercial Aviation in Algeria

In a report just to hand, by the British Consul-General at Algiers, it appears that the Algerian Assemblies have approved the inscription in the 1922 Budget of a credit of one million francs for the purpose of subsidizing certain aerial services, the proposal being that Paris, Marseilles and Algiers should be connected by an airship service and that aeroplane services should be established betweeen Algiers and Biska, and Algiers and Casablanca, respectively. The exploitation would be in the hands of private companies, who would have to fulfill certain obligations with a view to the immediate adaptation of their organizations to war purposes if required.

The construction of an aviation center with two hangars at Baraki, near Algiers, is contemplated.

Very shortly an experimental voyage between Marseilles and Algiers is to be undertaken in the "Nordstern," a German dirigible which has been delivered to the French authorities. It is expected that the service will be in operation next year, that the journey from Paris to Algiers will occupy between 16 and 20 hours, and that the cost will not be more than 1,000 francs a head.

French Air Line Expansion

From Paris it is reported that among the extensions planned by French air line companies during the coming year is the extension by the Compagnie Messageries Aériennes of their London-Paris service to Marseilles. At present Paris is not linked up by air to the south of France, travelers having to proceed to Toulouse by train. If the new line is established it should make a very considerable reduction in the time taken to get to the Riviera via Marseilles. It will also link up with the Latécoère lines to Morocco.

The Michelin Cup

December 31st is the finishing date on which competitors may attempt the flight around France for the Michelin Cup. Unless a French pilot manages to put up an exceptionally fine flight before that date, the cup will remain in Italian hands for the coming year. At present Martinetti has done the best time over a 3,000 km. circuit, having covered the distance in 35 hrs. 45 min. elapsed time. On December 21st Major Vuillemin made a plucky attempt to beat Martinetti's performance, but partly owing to fog and adverse weather conditions he had to abandon the attempt after having covered a little more than half of the 3,000 km. course.

Italian Government Encourage Aircraft Firms

As a result of the Italian Minister of War's program for civil aviation, many orders are, it is stated, about to placed for new machines. They include the following:

Fiat.—Two AL machines, two three-engine machines for 12 passengers and two Deutsk-type machines. The first two machines to carry six passengers each.

Ansaldo.—Two 300C biplanes and two 300T biplanes.

Macchi.—Two M.18 cabin machines with IF V6 engines, two M.18 economical-type machines with IF V6 engines and two M.20 with Anzani 45 h.p. engines.

S.*I.A.I*—Two S.13 bis, two S.16 and two S.16 bis machines.

Caproni.—Two biplanes 1921 type, 450 h.p. engine.

Orders will also be placed with the Breda Works.

All these machines will be at the disposal of their constructors for competition purposes, but they must be in the hands of the Technical Directorate in two years.

Gordon-Bennett Balloon Race, 1922

Alteration No. 1: It is now announced that the above contest will start from Geneva on August 6th, instead of September 2nd.

The Oscilloscope

The instrument known by this strange name was developed during the war at the Royal Aircraft Establishment, Farnborough, by Mr. A. J. H. Elverson, more especially for the investigation of some of the many problems connected with vibrations which occur on or about aero engines. It is understood to have given very valuable and informative results in regard to these matters and to be in use for that purpose at the present moment.

The instrument has now been put on the market by The Oscilloscope Syndicate, Ltd., care Herbert Kennedy and Co., 70, Fenchurch Street, E.C.3, and should serve many useful purposes in all branches of engineering.

The Oscilloscope is a form of Stroboscopic apparatus and in its general effects it may be said to be virtually an optical gear ratio. By its use high-speed machinery of all kinds can be observed and the actual working of the mechanical parts seen *under working conditions,* apparently running at a predetermined fraction of the true running speed at the moment. In general practice it has been found that an optical gear ratio of 1 to 100 is very convenient, but in special cases, such as direct-driven airscrews and very large high-speed machinery, an optical gear ratio of, say, 1 to 1,000 is more convenient and can easily be adopted.

The instrument is rigidly connected to and driven by the machinery under consideration, and the parts thereof to be examined are illuminated by a special form of electric lamp controlled by the instrument. Such parts thus illuminated will then appear to be going through their normal cycle of operations, but at a reduced speed, say, of 1 to 100.

In this way systematic faulty running at any point of the cycle of operations will at once be apparent, and these objectionable features will probably be even more apparent at certain critical speeds. It should here be noted that the nature of the motion under observation is immaterial and may be either rectilinear or rotary or any other form of motion.

Above and beyond this, it is also possible with this instrument to make the mechanism under consideration to appear to be stationary at any given point of its cycle of operation and thus to observe inaccuracies of operation at leisure. Thus it will be seen that not only can fundamental inaccuracies in operation due to faulty design be seen, but also by observation in an apparently stationary position temporary aberrations from normal working at that particular point of the cycle of operations can be detected.

Special arrangements are made to enable actual measurements to be made with considerable accuracy of any movements under observation, both in rectilinear dimensions and angular displacement, and thus it is possible with this instrument to plot, for instance, the actual valve diagram on an internal combustion engine under working conditions and afterwards to compare it with the designed valve diagram and from this comparison to get a very true idea of the effects of time lag, inertia, etc.

It will readily be seen that questions of vibration are thus very simply, rapidly and accurately dealt with, and it is possible to find the periodicity of any vibration with relation to any given shaft of the mechanism under consideration, without any calculation whatever. This is done by increasing the number of illuminating flashes per revolution, this number being gradually increased until a double image of the vibration is obtained. Under these conditions it is at once known that the periodicity of the vibration with relation to the driving shaft is half the number of illuminative flashes given per revolution.

There are many other applications of the instrument in several other fields, and it has been found that it is not difficult to use the same general process in connection with location of mechanical noises in machinery and not only to locate their position, but also their angular locus in the normal cycle of operations. This opens a very large field for further investigation, and is of immense use in many problems in all branches of engineering.

The great feature of the Oscilloscope is that it reveals things as they really are *under actual working conditions,* and is independent of such unreal things as mathematical rigidity, for instance, which are the fundamental reasons for the statement that all engineering is a succession of more or less inadequate compromises.

Mapping From the Air

Mr. B. Melville Jones, Professor of Aeronautics, Cambridge University, in a letter to the *Times* states that the Royal Air Force has placed at the disposal of the Engineering Laboratory a small experimental flight of aeroplanes working from an aerodrome in the neighborhood of Cambridge. The work is being carried on under the direction of Mr. Melville Jones with the close co-operation of the Department of Geography at Cambridge, and with the personal assistance and advice of Capt. H. H. Thomas, who is a member of the University and a former Air Force officer intimately connected with aerial surveying in Palestine.

Mr. Melville Jones is also in touch with the War Office Air Survey Committee and with the Photographic Department of the Air Ministry. The bulk of the work is being carried out by two research assistants financed by the Department of Scientific and Industrial Research.

In reply to his letter Comdr. Boothby, R.N., states that many of the difficulties of surveying would be overcome if airships were used instead of aeroplanes.

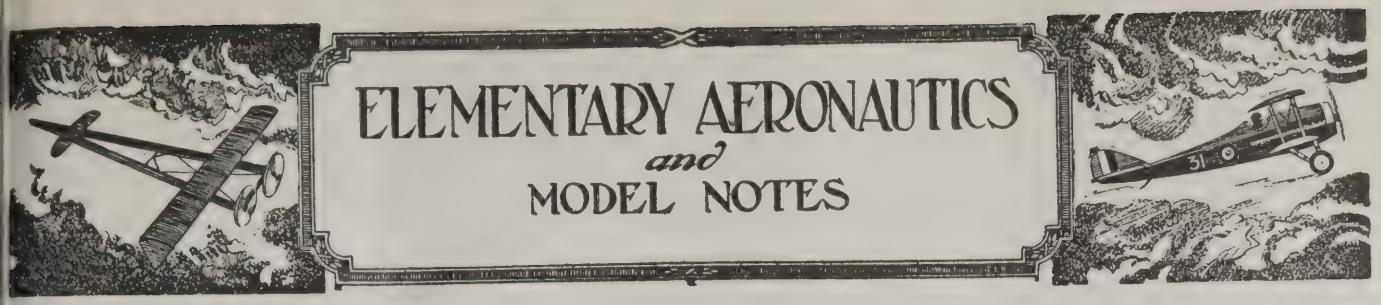
London-Cork Service

Plans for an air service between London and Cork that would shorten the journey to America by at least a day are being prepared. The distance from London to Cork is 400 miles and a modern commercial aeroplane could accomplish the journey in four hours.

Passengers and mails could leave London the day following the departure of a liner and catch up with the boat at Queenstown Harbor, while incoming mails and passengers would leave the ship at Queenstown and after four hours air journey arrive in London a day earlier than is now possible.

Aviators Employed to Prevent Drug Smuggling

Aviation was impressed into service in Honolulu recently by federal authorities in their endeavors to eliminate the smuggling of opium. A naval seaplane followed the liner Hoosier State out of port for a considerable time to prevent contraband narcotic from being dropped overboard and picked up by a small sampan, which is the method usually followed by the smugglers, federal authorities said.



The General Design of Model Aeroplanes

(Concluded from last week's issue.)

THE matter of aspect ratio is an open question and a ratio anywhere from 4 to 9 can be used to advantage. Considering weight as of chief importance, a ratio of about 5 will give good results. From a lift-to-drift standpoint the aspect ratio should be high. The more common ratios are from 6 to 7.

For distance flying an important item to notice in the construction of a model is that both propellers of a twin propeller model are of the same pitch and revolve at exactly the same speed. Otherwise the model will tend to do a "figure 8." Rigid wings aid in the securing of good adjustment for straight flying.

Altitude Attained

While meets for altitude are difficult to hold, it is important that any model aspiring to good performance be able to climb to a reasonable altitude. In order to do this the model should have more power than necessary at the beginning of the flight in order to level out when the power diminishes—as it does soon after the start.

The largest factor in the climbing ability of a model besides the question of surplus power is the question of propeller diameter. A formula for propeller diameter which may be used to find the minimum diameter allowable is as follows:

$$\text{Inches Diameter} = 200 \sqrt{\frac{1 \text{ Thrust (oz.)}}{\text{Flying Speed}}}$$

A diameter which is greater than the one given by this formula will be sufficient to give a good climb without greatly overpowering the model.

Quick Climbing

A model suitable for quick climbing should be one with large propellers and an abundance of power. Usually it is not the long duration or distance machines which have the greatest climbing ability but the ones with more released power than is necessary to furnish a reasonable high and consistent flight with a good glide at the finish.

For a quick climbing R. O. G. or hydro, the model should be set at rather a high angle in order that it assume its proper climbing angle from the start. An angle of six or seven degrees usually suffices.

Workmanship

Workmanship enters into the performance of every machine in that it shows the care that has been used in carrying out the details of design and construction. Any model builder who will take the pains to carefully construct each detail will not find it difficult to soon realize on that added time spent in getting superior results. The flying qualities of a model depend largely upon its weight, and a little saving in this respect here and there soon adds up to a large saving. So with the troubles experienced on the flying field. A careful builder is seldom handicapped by joints coming loose, rubber slipping off the hooks and such similar accidents. He sees that all of these little details are properly attended to when the model is built and he is then ready to fly when it is flying time and he does not have to rebuild his machine between each flight.

It is the attention paid to these small details which distinguish the reliable and consistent flying models, but I do not want anyone to think that accidents can be entirely avoided, because there will always at some time be something to fail. Do not, however, be discouraged by a smashed machine or two, but learn from each one and build the next one better.

Nature and Formation of Clouds

As clouds and mist are a real obstacle to the aviator, some notes on their composition and formation may interest students of the problems relating to flight. The atmosphere contains a certain amount of water vapor which is carried in solution similar to the manner in which salt may be dissolved in water. Hot water will dissolve more salt than cold water. If a hot "saturated solution" of salt be cooled, the crystals of salt will be deposited. In the case of a solution of water in air, the same effects are seen. Water is more readily soluble in warm air. By successively cooling air containing water vapor, the saturation point (sometimes called the dew point) is reached. If the air then be further cooled, small drops are deposited in the form of mist. Clouds consist of masses of mist formed in that manner.

The quantity of water which air will dissolve varies considerably with the temperature. For example, a variation of 30 degrees F. in temperature will multiply three times the amount of water which the air will dissolve. From this it will be observed that slight changes in temperature will cause the formation of clouds. Rain occurs when cooling takes place beyond the saturation point, causing particles of water to be formed which are too heavy to be held in suspension.

The highest fleecy white clouds, which are above the level of normal flight, consist of ice crystals due to the low temperature at the level of their formation. The lower clouds usually met with by the aviator may be grouped as "sheet clouds" or "heap clouds". The sheet clouds result from the stratified nature of the atmosphere. Layers of warm air coming in contact with cooler layers, become cooled also below their saturation temperature, a cloud being formed at the surface of contact. The cloud layer may be continuous or consist of isolated clouds. Heap clouds are formed by rising air current which become successively cooled as they rise.

The Scientific Value of Wind Tunnels

Wind tunnels, which produce for small models conditions paralleling those of flight, and provide for the prediction of the performance of an aeroplane as a whole, or the efficiency of any part of it, are becoming of increasing scientific value. In the Curtiss Laboratory one hundred percent results have been obtained in foretelling the general behavior of aircraft. The wind tunnel work has been under Dr. J. G. Coffin, Assistant Director of Research and formerly Associate Professor of Physics in the College of the City of New York. A graduate of the Massachusetts Institute of Technology, Dr. Coffin has given his attention to the intensive study of aerodynamical problems, and under his direction the Curtiss Model Shop has developed to a high point of efficiency.

Here aeroplane models and models of aeroplane elements are made by skilled craftsmen for wind tunnel use. Varying in span from a foot to three feet these miniature aeroplanes, wrought in mahogany and aluminum, are accurate to thousandths of an inch. Built to the engineering designs for a contemplated machine they are set up in the experimental chamber of the wind tunnel upon a spindle connected with a specially designed balance below.

The speed of the air which is drawn past the model is determined by the action of a propeller driven by a four-hundred horsepower motor. This motor is electrically controlled from the experimental chamber, and can furnish any speed desired, even to velocities approaching one hundred miles an hour. These speeds are accurately measured by means of a new type of absolute pressure gauge.

The balance can record wind pressures in all desired directions, to .0001 of a pound. Results are thus obtained which are the basis for almost any problem relating to the efficiency of aircraft. Shapes of wings can be tested for lifting capacity and for "parasite" resistance. The efficiency of a fuselage shape can be determined. Stability, head resistance, action of rudder and elevator, behavior of streamline wires, air-driven gasoline pumps, etc., are no longer matters of doubt for they can be settled in the laboratory previously to any field work.

Thus, the aeroplane has been reduced to a problem like a railroad bridge, and solved in laboratory and factory preliminary to its first actual use.



To Loop or Not to Loop

(*With most abject apologies to W. S.*)

To loop, or not to loop,—that is the question:
Whether 'tis better in the mind to suffer
The slings and arrows of outrageous kidding,
Or to take arms against this innuendo,
And now by looping end it?

To loop! Right now!
They say Hispanos won't run upside-down:
Suppose she conks before I reach the top,—
Stalls; slips; does flat turns on her back;
Then falls off, dives or spins!

To try a loop,—
To stall! To stall,—to spin! Ay, there's the rub,
For in that spin what ills may lurk! That breathless
Drop; that dizzying swing; the buffets of
The mad wind's hand! It makes my flesh to creep;
My vital stream runs cold!

And that were not enough
How she does hate to come out of a dive;—
How long it seems before she lifts, and then
With what a fearful suddenness;—her wings
Flex upward—Oooh-h-h! And if they hold not—Well!
To loop? Not me! To loop—to stall: to stall
Perchance to spin; and then to bring her out
Too swiftly,—knock her wings off: crash.
Oh, no. I think not. This is good enough
For me. I'm satisfied to be conserv-
Ative,—fly straight—do gentle turns—and live.

Ad Astra.

An Explanation

A touring party were having breakfast in Buffalo. When the eggs were served, one exclaimed: "What large eggs!"
Said another: "Yes, these are Buffalo eggs."

She—"I see a woman fell the other day and bit off part of her tongue.
He—"Was she married?"
She—"Yes!"
He—"Huh! Some men have all the luck!"—Judge.

Why Not?

"Struggle, but don't get rough when you are kissed," is the advice ladled out to co-eds at Northwestern University in the December number of the Purple Parrot, just issued under the student editorship.

Here are the rules, as laid down at the great Methodist university:

"When a man kisses you, struggle fiercely at first and then appear gradually to be overcome by his superior strength.

"Close your eyes and hold yourself rigid, relaxing a bit if the kiss endures.

"Take your breath in little gasps.

"Let a variety of expressions flood your face—anger, sorrow, despair, joy—it is important that all these be registered.

"Struggle occasionally as if to free yourself.

"Scratch and bite, if opportunity presents itself, but don't dig too deeply.

"As he is about to release you, faint, if possible.

"If you will observe these instructions carefully, he will, most probably, kiss you again."

Sop. Camels

I love little scout-planes:
Their shapes are so pert.
And if I don't crash them
They'll do me no hurt.

—Ad Astra.

Biology Pro: Come now, can you tell me something about the joints?
Tres Fresh: Sorry, sir; but I'm quite a stranger in town.
—Brown Jug.

The Saturday Line-Up

Teacher: Oscar, what is the Ancient Order of the Bath?
Oscar (*puzzled*): I dunno; Johnny comes first, then Willie, then the baby, and then me.

A Tragedy of the Ultimate Straw

As I was out a-walking
Upon a summer's day
I spied a crumpled aeroplane
Reclining on some hay.

The fuselage was broken,
The wings were somewhat bent;
The engine in the ground had made
A quite alarming dent.

The pilot was a stoic:
He sat upon a stone,
And did not deign to cuss his luck
Or to emit a groan.

Until I mildly questioned him—
The twentieth that day—
"Oh, would you tell me, pray, kind sir,
"Do you always land that way?"

—Ad Astra.

Y. W. C. A. Wanted

Prof.: Give some examples of new words being introduced into the English language.
Co-Ed: Vamp, toddle, necking, shim—
Prof.: Young lady, in your case I'd advise a good Christian counsellor rather than English instruction.—*Punch Bowl.*

Lines to Betty's Line

It wasn't Betty's deep blue eyes that got me;
It wasn't Betty's hair of Titian hue;
It wasn't even Betty's wicked dancing—
It was the heavy line that Betty threw.

Twentieth-Century Girl

She: Who was that handsome fellow that sang so beautifully about love?
He (*neither handsome nor musical*): Oh, that bimbo! He chews tobacco, drinks flavoring extract, and has a wife out in Utah.
She: How romantic! When can I meet him?
—Punch Bowl.

These jokes may be old,
And should be on the shelf;
But if you don't like them,
Send in some yourself.

Just Try to Be the Fellow That Your Mother Thinks You Are

While walking down a crowded street the other day,
I heard a little urchin to a comrade turn and say:
"Say, Chimmie, lemme tell youse, I'd be happy as a clam
If I only was de feller dat me mudder t'inks I am;
She t'inks I am a wonder, and she knows her little lad
Could never mix with nuttin' dat was ugly, mean or bad.
Oh, lots of times I sit and t'ink how nice 'twould be, gee whizz,
If a feller was de feller that his mudder t'inks he is!"

My friend, be yours a life of toil or undiluted joy,
You can still learn a lesson from this small, unlettered boy:
Don't aim to be an earthly saint with eyes fixed on a star;
Just try to be the fellow that your mother thinks you are.

Author Unknown.

Questions in Seamanship

I am a knot and not a knot. You will find me forward on the starboard side, inside on the outside and alongside the ship's side.

Is the "shivering of timbers" confined exclusively to cold latitudes?

No, they shiver when a ship gets coaled.

To what school are cables sent to get taut?

Is a ship "in irons" when she is placed in dock?

Answer these and we will slip you some more.—Idaho Yarn.

AIR LAIRD PLANES WICHITA KANSAS

The Laird Swallow

"America's First Commercial Airplane"

THE Swallow's carrying capacity—three passengers, baggage and full fuel load—is one of the reasons that it is fast becoming America's most popular commercial ship. Let us send you our booklet.



Now Priced at $4,500

E. M. LAIRD COMPANY

Manufacturers

WICHITA, KANSAS

General Sales Offices

2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.
2216 So. Michigan Ave., Chicago, Ill.

Please send me details of your new sales plan and copy of booklet.

Name .....

Address .....

.....

AA

(*Concluded from page* 474)

but 80 pounds would not cause any excessive bending movement on this tube. Also, the thrust of the propeller which is approximately 700 pounds, has a theoretical factor of safety of 8. The tubes were cast by the Aluminum Manufacturers, Inc., of Cleveland, Ohio, and were produced of their No. 195 metal, heat treated, having an ultimate strength of 40,000 pounds per square inch, or approximately twice that of plain cast aluminum. The elastic limit of this metal is 30,000.

The propellers were attached and all necessary clutch adjustments were made before the motors were started on the stand run. We found that at half power, with both motors, the tubes were absolutely steady, and there was an entire absence of gear noise, and at half power the oil temperature only rose 5 degrees above room temperature. It had been our thought to apply the power gradually, but we opened both motors wide, and both tachometers indicated 1,550 RPM, giving propeller speed of 775 revolutions per minute. This being a static test, the propellers would go up to their design speed of 800 revolutions while in flight. The motors were left open for three hours, at which time the center gear box showed a temperature of 78 degrees Fahr. or 13 degrees above room temperature, which, of course, for a transmission of this type, is quite remarkable. At this speed, and during its entire operation, there was not the slightest sign of vibration of any nature, and an entire absence of noise, gear hum, or any mechanical troubles that would indicate improper design. An additional run of 10 hours was completed without the necessity of making any adjustments on the transmission.

While the preliminary drawings and general arrangement were laid out by the Aeronautical Design Division of the Goodyear Tire and Rubber Company, the entire detail design and production of the transmission was put in the hands of Mr. John Riise, Chief Engineer of the Tractor Division of the Wellman-Seaver-Morgan Company, to whom we credit the remarkable success of the transmission unit.

The weight of the transmission without propellers was 593 pounds. The blowers and clutches weighed 88 pounds. This is just slightly greater than the weight of outriggers on some of the airships built in the past.

The transmission driven airship permits the motors to be placed within the car, thereby making them very accessible and in the case of non-rigid and semi-rigid airships, permits Sirocco type fans to be attached directly to the motors, thereby permitting the elimination of scoops, which offer considerable resistance and add considerable weight. It permits any mechanical adjustments to the motors, and in the case of the above unit, a complete cylinder head could be removed while in flight. As the heating up in any transmission is a direct indication of power losses, due to the entire absence of this trouble in the Goodyear type transmision, it is conservatively estimated that an efficiency of 98 per cent is obtained. Due to the fact that the propellers are 11 ft. in diameter, and have a pitch of 10 feet 6 inches, and also due to the reduction of head resistance and the absence of protruding members, there should be a considerable gain in the speed of the unit.

In view of the unit arrangement of the transmission a reverse gear was inserted, which permits the propellers to be reversed without difficulty. The tractor type propellers were so arranged as to permit the edge of the tube to be streamlined. The radiators are to be set on bosses located on the tube, thereby placing them directly in the slip stream. The tractor type propellers offer the advantage of safety by keeping all these mechanical parts to the rear of the blade.

The characteristics of the unit are as follows:

Speed	60 m. p. h.
Rate of climb	1000 ft. per min.
Rate of descent	800 ft. per min.
Cruising radius—full throttle	14 hours
Cruising radius—reduced throttle	20 hours
Percentage of useful load	39
Length	170 feet
Diameter	48 feet
Crew	7

While this unit is an experimental airship, it has proven that even with the enclosed car, transmission, reverse feature and two additional passengers, it is a decided improvement in the non-rigid type of airship. Ships of this design could be constructed up to 300,000 cu. ft. capacity without the slightest difficulty. The entire design adapts itself to the insertion of a rigid keel, which would permit ships up to at least 1,000,000 cu. ft. to be built, with a tremendous saving in the structural weights, and with an assurance of a very high percentage of useful lift.

PIONEER INSTRUMENTS

TRADE MARK REGISTERED

Proper instrument equipment assures greater safety, better performance, higher efficiency.

We manufacture and sell a complete line of aircraft instruments and accessories of unequalled quality and proven reliability. Pioneer instruments are unconditionally guaranteed to function properly. Our products include

Compass, Turn Indicator, Air Distance Recorder, Air Speed Indicator, Altimeter, Banking Indicator, Running Lights, Signal Lights, Search Lights, Rate of Climb Indicator, Speed and Drift Indicator, Tachometer, Gasoline Level Gauge, Fuel System, Course and Distance Indicator, Flight Indicator.

Pioneer instruments are used by the Army, Navy and Post Office Air Services.

Write for Information

PIONEER INSTRUMENT COMPANY

MAIN OFFICE AND FACTORY BROOKLYN N Y

WASHINGTON 441 STAR BUILDING | PARIS 97. BOULEVARD ST. MICHEL | SAN FRANCISCO 839 POST STREET

SPECIAL OFFER

New wheels with casing and tube

$12.00 comp. F. O. B. Buffalo

Canuck JN4 and 0X5

Spares and Supplies

Special prices from now until end of season. Act quick, don't wait until Spring to refit; use your spare time in the winter season.

Write us direct for quotations

ERICSON AIRCRAFT LIMITED

120 King Street E. Toronto, Canada

L. P. WITHERUP

Mechanical Designing Engineer

Specialist on

Lubrication and Bearing Problems. I Make Your Own Bearings or Bushings Work Without Heating.

DESIGNING, DEVELOPMENT, DETAILS, DELIVERY of **Internal Combustion Engines of any type, class or service. Airplanes to Farm Engines. Invention Devices, Manufacturing, Air Compression, Pattern and Machine Work.**

If you have a two-cycle engine giving you trouble or will not develop its full power, write me particulars and I will straighten it out.

LOCK BOX 1472, CINCINNATI, OHIO

MOTOR REBUILDING

CYLINDER GRINDING

ALUMINITE PISTONS

Iron Pistons, Piston Pins and Rings.

COMPLETE MOTORS

Parts for all airplanes and motors.

Finest equipment in U. S. for motor work.

GREEN ENGINEERING COMPANY

Dayton, Ohio

Main St., at Burns

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

PHILADELPHIA AERO-SERVICE CORPORATION

636 Real Estate Trust Bldg. Philadelphia

Aerial Photographs

WE are always in the market for good aerial photographs, and we invite our readers to submit to us aerial views of landscapes, seascapes, forests, mining regions, etc. Address: Photo Department

AERIAL AGE WEEKLY

280 Madison Avenue New York

JN4D airplanes	$1000.00
JN4D Fuselages complete less fabric	125.00
Fuselages broken	25.00
Wings less fabric JN4D Canuck	15.00
Fokker ships less motors in poor condition	75.00
Hall Scott motors, new	300.00
OX5 motors, fresh overhaul	250.00
Several tons JN fittings	.25-50

All woodwork for JN, new and extra low price. Limited number of students accepted. Will trade material for good car.

FLYING U SCHOOL OF AVIATION

Box 26, S. San Antonio, Texas

IN order to make room to start manufacturing our three place $2500.00 American product of high efficiency and economy airplane we offer new linen and cotton covered Canuck wing panels at $100.00 each. New rudders, new elevators, new ailerons, each $16.00. OX5 motor parts 50% off. New propellers —each $17.50, OX5.

PARKER AIRCRAFT CO., Perry, Iowa

Engineering

AERIAL AGE WEEKLY

UNIVERSITY OF ILLINOIS LIBRARY JAN 31 1922

OL. 14. No. 21 JANUARY 30, 1922 10 CENTS A COPY



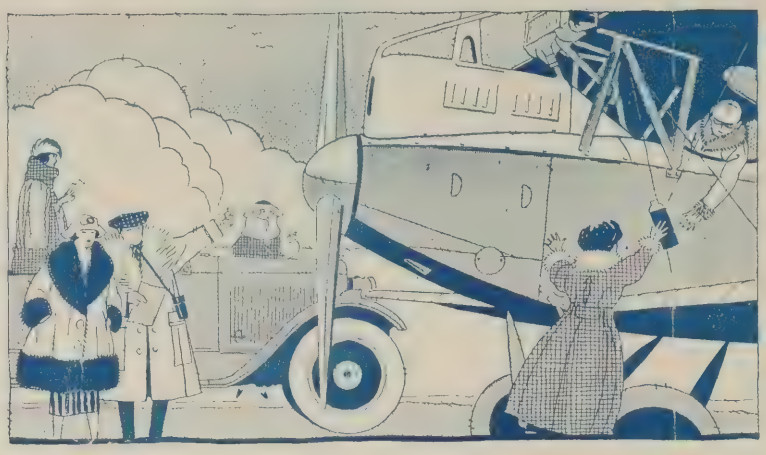
The Sport Farman which has been arousing great interest in various sections of the United States

Text of the Conference Discussion on Aircraft

Air Lines and Some of Their Problems

Danger for the Air Mail

SHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
ptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



Best in the Air—Best on the Road

With an enviable record of achievement that has made it the acknowledged leader in the aviation field, the B. G. Spark Plug is now demonstrating its marked superiority for automobile ignition. Owners of cars of quality should insist on having the B. G. Plug because it is

The plug that *cleans itself.*

The plug that is *guaranteed* against *failure* from carbon and *fouling* by oil.

The plug that gives *complete ignition,* effecting *maximum power.*

The plug that *saves gas*—by adjusting for a leaner mixture.

The plug that is sold on a money-back basis if you are not satisfied after 30 days.



The B. G. Corporation
33 GOLD STREET :: NEW YORK

B·G SPARK PLUG
The Plug that Cleans Itself

January 30, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 21

TABLE OF CONTENTS

Danger for the Air Mail 487
Aeroplane Supervision 487
The News of the Week 488
The Aircraft Trade Review..... 489
Text of Conference Discussion on Aircraft 490
Air Lines and Some of Their Problems 492
Traffic Airships With Special Reference to Economy 495
Naval and Military Aeronautics... 499
Aero Club of Pennsylvania..... 500
Foreign News 500
Elementary Aeronautics and Model Notes 501
Aeronitis 502

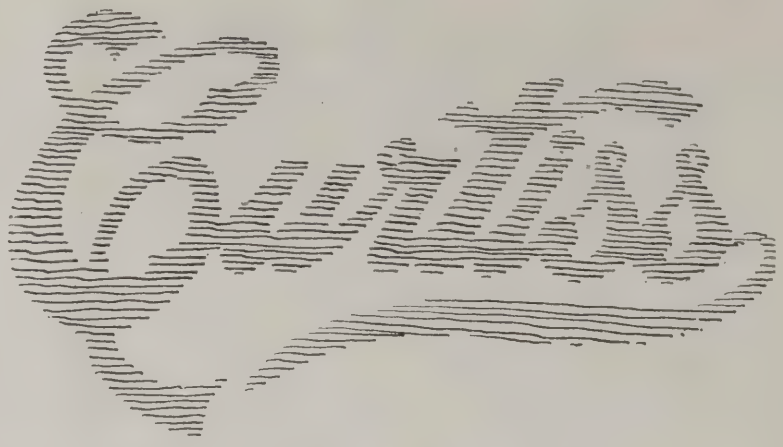
PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

DEALERS WANTED



Three 3 place Lincoln Standard tourabouts leaving our flying field December 21st, 1921, the plane to the left for Los Angeles and the other two for Oklahoma City. Reading from left to right: G. E. Bennett of Los Angeles, who just purchased plane to left; Ray Page, Gen. Mgr. Nebraska Aircraft Corporation; Jack Atkinson, Pilot, who will fly ship to the West Coast; L. L. Bell, Kansas City, who flew as passenger in center ship to Oklahoma City, where he will learn to fly his new Tourabout; I. O. Biffle, our Test Pilot and Chief Instructor; S. Long of Kansas City, who flew as passenger to Oklahoma City in ship to right, to take his flying instruction in his new Tourabout. Zero weather has no effect on the flying qualities of our planes.

NEBRASKA AIRCRAFT CORPORATION
Lincoln, Nebraska



Announcing 1922 Price List

NEW PRODUCTION

	LIST PRICE
ORIOLE:	
With OX5 Motor	**$3000.00** F.O.B. Buffalo, New York
With K-6 Motor (1919)	**4400.00** F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	**4800.00** F.O.B. Buffalo, New York
SEAGULL:	
1919 K-6 Motor, dual stick control	**5200.00** F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	**5600.00** F.O.B. Garden City, L. I.
STANDARD:	
With C-6 or K-6 Motor	**3600.00** F.O.B. Garden City, L. I.
MOTORS:	
C-6 or K-6 (150 H.P.)	**3000.00** F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

JN's:	
JN4D with new OX5 Motor	**$2400.00** F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	**$1200.00 to 2200.00** F.O.B. Dallas, Texas
STANDARDS:	
With new OX5 Motor	**2000.00** F.O.B. Houston, Texas
With overhauled OX5 Motor	**1700.00** F.O.B. Houston, Texas
Without motor, rebuilt for OX5	**1100.00** F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	**1600.00** F.O.B. Garden City, L. I.
Without motor, as received from Government	**800.00** F.O.B. Houston, Texas
MOTORS:	
OX5 New	**800.00** F.O.B. Various concentration fields
OX5 Overhauled	**600.00** F.O.B. Various concentration fields
OX5 As received from Government	**500.00** F.O.B. Various concentration fields

NOTE: Where delivery is made from other than F.O.B. points, accrued transportation charges must be added.

WRITE FOR DETAILS IF INTERESTED IN BECOMING A DISTRIBUTOR OR DEALER, STATING TERRITORY DESIRED.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY LONG ISLAND, N. Y.

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., January 30, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, JANUARY 30, 1922 No. 21

Danger for the Air Mail

IF the Senate is without honor at present, the committee on appropriations for the House is without imagination. It has reported back the postoffice bill minus any provision for he air mail. A service considered by the director of the udget to be worth $2,200,000 is rated by a group of congress-ıen as a liability.

This action would not be as perplexing as it is had it not been ttempted before, year after year. Since the first successful ublic flying was done in the United States in 1908, Congress as, apparently, considered that any request for money to be sed in advancing aviation was an attempt to "put something ver" on it. Contrasting the ability of Congress to promote ying with the remarkably little it has accomplished in the way f assistance, one is justified in calling it the greatest obstacle) aeronautical progress we have ever had in America.

The air mail is a pretty good case in point. This service has een in operation almost four years. Acknowledgedly it is the ıost successful aeroplane service, civilian or military, in the orld. It has not cost us during its entire life half the price f one of the battleships Congress voted to build and may soon ote to destroy. It has perfected aeronautical equipment and eveloped experience worth a fleet of enemy battleships should e ever again have these to encounter. At present it main-ains a coast-to-coast service for us. This service has been 9 per cent. perfect during the last year, and has carried almost 00,000,000 letters. Yet we are now called on to explain again) men who should now know the air by three years' experi-ıce why the service is valuable to the nation and why its ıolition would be a financial loss to us instead of an economy.

It is incredible that the attitude of the appropriations com-ittee of the House is the attitude of Congress. There are ıe Congressmen who will surely not tolerate this deliberate ıppression of mechanical progress and national interest. The r mail must be continued. Let us hold out our check on a ınboat or a light cruiser instead.

Aeroplane Supervision

FATALITIES among army and civil aviators have now and again run so high as to cause some to wonder whether the men who go into the air with linen wings and motors are always as cautious as they should be. But even under the best conditions there would be mishaps and one must look upon these losses, tragic as they are, as largely inevitable, the price of aeronautical progress. The aviator knows the chances of death and voluntarily takes them.

Those who prefer to stay in the ground have a right to expect immunity from the hazards of aircraft. Men and women who fly for military or commercial purposes, or merely for the fun of it, as some do, must learn that the venturesome or debonair attitude they often hold toward their own safety cannot be carried beyond their personal concern. The death of a woman and the severe injury of a man from the whirling propeller of a grounded and pilotless plane at Red Bank, N. J., shows anew the danger in which onlookers sometimes are placed.

According to the Aeronautical Chamber of Commerce, there are 1,200 aeroplanes operated by civilians in the United States. There are 125 commercial aeroplane operating companies; 275,000 passengers were carried in the last year. Some, like the machine that caused the New Jersey accident, are owned and driven by individuals for sport. Army and navy aviators work under strict regulations which forbid low flying over towns or crowds. The increase in privately operated machines gives rise to the question as to whether some stricter regulation in the interest of the public has not become necessary.

Many have grown weary of excessive numbers of laws and police rules. But, unless there is more general regard for public safety on the part of aviators, we probably shall have more and more rigid official supervision of flights.

(*Editorial in N. Y. Sun*)

THE NEWS OF THE WEEK

The Zeppelin for America

Since our last report on the subject more details have become known of the Zeppelin which the Council of Ambassadors voted to permit Germany to build for the United States Navy. This big airship probably will be built within a year and will then fly to America. It will make the voyage at the risk of the German Government, this being one of the conditions required by the United States Navy Department. Since it will be a dirigible of 70,000 cubic meters capacity and Germany's final Zeppelin, the Government has decided to accept the risk because of the opportunity it provides for proving Germany's superiority in sonstructing lighter than air machines.

The final details of the contract are still unsettled. But unofficial negotiations have already settled the fact that the Zeppelin will be built for America and will fly to its destination. Zeppelin experts assured the Foreign Office that they were not afraid of the test. The success of a Zeppelin which during the war flew to East Africa and return, or a distance equal to that from Germany to San Francisco, makes a voyage to America a fairly simple adventure by comparison, according to the German view.

Before the order is finally placed Germany must be informed of the sum at which the Allies estimate the value of the seven military drigibles which were destroyed after the revolution to prevent their surrender. America's share in this also must be estimated and if this is not as large as the cost of building the 70,000 cubic meter airship America will have to pay the balance.

There is another detail which may be of great importance in determining whether America's Zeppelin will be equipped with all the latest improvements. That is whether the Allies will require Germany to give them the plans of America's airship. In the resolution permitting Germany to build the Zeppelin the Allies reserved this privilege for themselves, and unless the United States insists in her own interests Germany may build an old type airship for the sake of guarding her secrets.

Under the Versailles treaty the hangar in which the Zeppelin is erected, together with the special machinery uesd in its construction, must be destroyed and the workmen dispersed when the American contract has been filled.

W. B. A. C. Progressing

The organization of the World's Board of Aeronautical Commissioners is making rapid progress.

The class of people composing the organization as Commissioners and Chairmen are the leading business and professional men of the world, capable of putting forward the use of aircraft until its full benefits are enjoyed by all.

To date, Jan. 16, 1922, there are: 91 Countries and Colonies of the World represented by 108 Commissioners. 1518 nominated for membership in the United States. 2405 Counties out of 3048 represented by acceptances of State Nominees. 6033 Cities and Towns represented by acceptances of County Nominees. The officers say that when the organization is completed it is estimated there will be 100 Countries and Colonies of the World represented by 125 Commissioners.

Spokane News

Spokane, Wash.—Ex-Lieutenant Floyd Kelso of Lewiston, Idaho, 100 miles southeast of Spokane, was the principal in an unusual experience near Spokane recently. He had come to Spokane to take delivery of a 80 h. p. Curtiss machine, and started in the homeward flight. Ten miles out of the city the plane entered a "war among winds." Opposing currents appeared to concentrate from all points of the compass, forming an aerial whirlpool. Kelso d
clared it was the most treacherous gale h
had encountered in five years flying. Th
machine was tossed about like a leaf ar
was entirely out of control. Finally th
pilot managed to get out of the maelstro
into calmer air and made a landing in
farmer's field.

Six students are enrolled in a flying cla
under Lieutenant Kelso at Lewiston ar
as many more will begin the course ne
month. With one or two exceptions th
students are wheat growers living ne
Lewiston, who will use their machine
when purchased, in private flights only.



Eddie Stinson and Lloyd Bertaud, pilots, and John Larsen, owner, of the J-L-6, that established the world's endurance record.

CALENDAR OF COMING EVENT

under sanction of

AERO CLUB OF AMERICA

April 30th (1 or 2 days)
Spring Show and Opening Meet
Place: Curtiss Field, Mineola, L. I., N. Y
Conducted by: Curtiss Airplane & Moto
Corporation, Garden City, L. I.

September 4th (about) 1-day meet for
Detroit Aerial Water Derby
Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy
Place: Detroit River and Lake St. Clai
Conducted by: Detroit Aviation Societ
4612 Woodward Ave., Detroit, Mich

September 15th (about) 3-day meet
Pulitzer Trophy
Detroit Aerial Derby
for Aviation Country Club of Detro
Trophy and Liberty Engine Builder
Trophy and Class Race Prizes
Invitation Races
Detroit News Aerial Mail Trophy
for Multimotored Aeroplanes Speed Tria
Place: Mt. Clemons Field, Detroit, Mich
Conducted by: Detroit Aviation Societ
4612 Woodward Ave., Detroit, Mich

August 15th (about)
In Preparation by the Aero Club of Americ
American Elimination Trials, if Necessar
for La Coupe Deutsch de la Meurth
(Race to be held in France about Oc
tober 1st. Place: Mitchel Field, Mineol
L. I., N. Y.

September 30th
First Annual Interservice Championship Me
Open to the personnel of
The U. S. Army, Navy and Marine Corp
Air Service
Championships in Single Seater Fightin
Bombing Reconnaissance Races Photog
raphy Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)
Foreign Events
Coupe Jacques Schneider
Contest for Flying Boats and Seaplane
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Vi
Tor de'Specchi, Rome.
American entries received by the Aer
Club of America.

October 1st (about)
Coupe Henry Deutsche De La Meurth
Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 3
Rue François-1, Paris.
American entries received by the Aer
Club of America.

The AIRCRAFT TRADE REVIEW

A. S. M. E. News

The first issue of the A. S. M. E. News appeared on December 22 and will be published twice a month from now on by the American Society of Mechanical Engineers. The publication carries information regarding activities of the society, its local sections and professional divisions.

The Slotted Wing

We are in receipt of the following letter from Walter E. Gilbert, of Vancouver:

Your leading article, by your Mr. B. C. Boulton, entitled "The Fallacy of the Slotted Wing," which appeared in AERIAL AGE, issue of November 5, has just come to my notice.

As a commercial pilot, one who makes no attempt to dispute the accuracy of the purely technical aspect of your arguments, I beg to offer some few words of criticism of your statements, from a practical view point only.

To me, the condemnation of Mr. Handley-Page's "slotted wing," as the exemplification of a "fallacious principle" is not only unjustified at the present time, but also to some degree, inaccurate.

I have had personal experience with the type of "Handley-Page" to which this new wing has been applied, and have observed the performance thereof since the alteration, though I have not in person flown it in this condition. Hence my interested opinion on its value.

One of your major objections appears to be that the Handley-Page wing is not applicable to machines for essentially war-time use, and one of the concessions you make in its favor is that it makes possible "decreased landing speed with wing loadings kept close to their present values," adding, however, that "landing speeds obtained with present design are reasonably satisfactory."

In dealing with these points, it must first be realized that the Handley-Page multiple-engined commercial machine is intended as a commercial carrier and not as a war-time weapon. Its possibilities as a "long-distance bomber" are now subordinated to its peace-time uses, as exemplified by its record of service in the "London-Paris Air Line," in the period 1919-21.

Further, while securing speed without unnecessary sacrifice of power applied is highly desirable in the heavy commercial machine, surely the issue of paramount importance is that of providing for the *safety* of passengers, freight, and the very valuable machine itself. And in securing this, one of the most desirable assets is the ability to be landed in the small areas available in cross-country flying when sudden need arises. An examination of the reports issued by the Air Ministry in London demonstrates quite clearly how greatly "forced landings," from one cause or another, contribute to the annual total of casualties and financial loss in commercial aviation.

In "forced landings," granted that the pilot possesses the requisite amount of skill, a low "landing-speed" is *all*-important. And while those now existing may be termed "reasonably satisfactory," the comparative hazard in "forced-landings" is all too apparent, and goes to show that a further reduction in the rate of "landing-speeds" is essential, if *really* "safe" air-travel is to be secured.

One way of securing this reduction is by the substitution of the "slotted wing." With it, in its original form, the desired result was partially secured, and more recent tests have shown a further improvement, using the same machine as in the original trials.

In considering these few suggestions, does it not appear that, Mr. Kerber's theory notwithstanding, the Handley-Page Wing "fallacy" has actually contributed to the safety of commercial aviation, and that after all Mr. Page's designer—a pioneer in aeroplane design—should, results obtained rather than opposing theories being considered, be given a little more consideration by your "technician" before being condemned as the parent of a "false train of thought?"

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, November 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST: Gallons of Gasoline	Total Time Run Hr., Min.	Total Miles Run	Cost per Hour	Cost per Mile
TERN York-go.....	$4,320.15	$929.97	$2,472.68	$3,741.12	$1,519.12	$1,153.62	$3,254.04	$1,673.18	$4,352.29	$4,718.79	$190.31	$2,376.13	$841.03	$31,542.43	12,524	441 23	39,981	$71.44	$0.79
TRAL go-Springs	5,000.80	1,568.95	a10,985.70	2,862.74	1,207.63	799.87	3,696.49	2,423.24	6,099.45	7,595.09	275.62	3,441.30	1,218.03	47,174.91	17,994	682 21	61,287	69.14	.77
TERN Springs rancisco	3,336.55	561.27	b12,922.13	1,876.61	1,381.21	577.47	3,362.32	1,673.19	4,452.11	5,150.16	190.31	2,376.13	841.03	38,700.49	11,240	478 47	41,877	80.82	.92
and ges....	$12,657.50	$3,060.19	$26,380.51	$8,480.47	$4,107.96	$2,530.96	$10,312.85	$5,769.61	$14,903.85	$17,464.04	$656.24	$8,193.56	$2,900.09	$117,417.83	41,758	1,602 31	143,145	$73.27	$0.82

a Includes new motor in plane No. 166.
b Includes new motors in planes Nos. 158 anf 167.

Total Operating Cost	$117,417.83
Permanent Improvements	7,134.65
Grand Total	$124,552.48

COST PER MILE			
Division	Overhead	Flying	Maintenance
Eastern	$0.23	$0.24	$0.32
Central	.17	.21	.39
Western	.21	.20	.51
Entire Service	$0.20	$0.21	$0.41

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio; Testing and Experimental Work.

Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories; Warehouse.

Flying consists of: Gas; Grease and Oil; Pilots.

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

TEXT OF THE CONFERENCE DISCUSSION ON AIRCRAFT

FOLLOWING is the text of the official communiqué issued by the Conference on Limitation of Armament dealing with the discussion of aircraft in the session of the Committee on Limitation of Armament:

The eighteenth meeting of the Committee on the Limitation of Armament was held Jan. 9, 1922, in the Pan-American Building. The committee had under discussion the report of the Subcommittee on Aircraft.

Mr. Schanzer said:

The subcommittee of experts has come to the conclusion that there is no practical method for limiting military and naval aviation. The Italian member of the subcommittee was alone of the opinion that such a limitation could be obtained by limiting the number of pilots of the permanent military organizations; and since the other powers are willing to accept the conclusions of the subcommittee and a proposal aiming at the limitation of air armaments would have no chance of being accepted today, we will limit ourselves to expressing the desire that the future conference which will be called to study and define the laws of aerial warfare should take up again also the question of the limitation of aerial armament.

We have always insisted on the limitation of armaments in all fieldsand would deem it regrettable that competition, which we have partially succeeded in excluding from naval armaments should be transferred to the dominion of miltary and naval aviation; this would be a serious drawback to the work of the economic reconstruction of our countries, which it is the duty of each of us to have in view.

MR. UNDERWOOD:

Mr. Underwood said that he had not expressed his views very much to the conference. He was in hearty accord with what it had done. He himself believed in real disarmament, looking to the permanent peace of the world, and he would be very glad to vote for the cutting out of any instrument of war if it really affected the situation; but heavier-than-air craft and lighter-than-air craft both were used for land armament as well as sea armament. The man who was trained in one machine could fly in the other and, in the main, the machine that might be used with land armies, with slight changes could be used in naval warfare.

He personally would be very glad to see the question of limitation of land armament taken up, but he understood the conditions that confronted them and knew that it was not probable that it would come before this conference, for reasons that it was not necessary to go into. Therefore it did not seem to him practicable to pass resolutions in reference to the limitation of aircraft at this time. For that reason his view was in accord with the view of the technical subcommittee.

MR. BALFOUR:

Mr. Balfour said that it was impossible to resist the practical conclusions of the Subcommitte on Aircraft with regard to the limitation of heavier-than-air craft, which he understood was the point for immediate discussion. This was regrettable, because one must regret anything that restricted our power to limit armaments, whether by land or sea or air. But we must accept the facts as they now appear, and leave it to some future time to deal with the subject, when the technical differentiation between war and peace aircraft should have become clearer.

Senator Underwood had put with great force a further special obstacle that stood in the way at the moment. As he had shown, the conference was precluded from dealing with the larger problems of land armaments. Aircraft were land arms as well as naval arms. Accordingly, to deal with the limitation of aircraft at this time would be to deal with only a fraction of the subject of land armament and to leave wholly untouched the larger proportion of the great problems connected with it. There was another general argument pointing in the same direction. Unlike the case of submarines, in the case of aircraft military and civilian uses were not sharply divided. There was practically no commercial civil use for a submarine, but there were many who thought that the development of aerial invention was going to exert an immense influence upon the economic development of mankind and upon the inter-communication of different peoples. In the present stage of their knowledge of air matters it seemed quite impossible to limit aircraft designed for military uses without also limiting aircraft designed for commercial uses; so that every restriction which could be put upon aircraft would have a double reaction.

It might, and perhaps would, diminish the number of aircraft which could be used for military purposes, but it could not carry out that object without also diminishing the number of aircraft to be used for the peaceful purposes of international intercommunication. In those circumstances he must admit with reluctance, but with a clear conviction, that probably the subcommittee was in the right when it said it would be quite hopeless, and not only hopeless but undesirable, to attempt at the present time and in the present stage of our knowledge to limit aircraft. He has, therefore, prepared to give his adhesion to the first part of the first resolution.

MR. SARRAUT:

Mr. Sarraut said that he had just listened to the presentation of a certain number of observations in consequence of which he desired to state that the French delegation gave its full assent to the first resolution proposed by the committee. The reasons adduced appeared to him excellent and the conclusion reached by the impartial investigation of the experts was luminous.

If he might be permitted to express his personal point of view, he would say that he still regarded with the gravest apprehension any act which might be of a nature to paralyze the progress of aviation. He had a profound belief in the beneficial effects to humanity of aviation. If it resulted in terrible engines of war, it might also be an instrument of the first importance in time of peace.

Already, indeed, the plane was used in the adminstration of those distant and desolate lands called great deserts by the experts, and where, more than anywhere else, suffering humanity had need of care and assistance. In the French colonies, very serious efforts had been made to effect the long-distance transportation of essential objects and to bring medical and surgical assistance. Very important results had already been attained along these generous and humane lines.

Under these conditions, it would be very wrong to do anything that might hamper the progress of aviation, and it was with this understanding that the French delegation gave its full and entire adherence to the proposals of the committee.

BARON KATO:

Baron Kato said that the question of aircraft did not demand elaborate discussion at present. He believed, however, that the time would come when it would be necessary to effect a limitation upon the use of aircraft. He agreed with the conclusion of the subcommittee that it was impracticable at present to effect any limitation upon the use of "heavier-than-air" craft. Therefore, he accepted the proposal on behalf of the Japanese delegation.

SECRETARY HUGHES:

The Chairman (Mr. Hughes) said that he thought that they all felt a deep disappointment in being unable to suggest practical limitations on the use of aircraft in war or on the preparation of aircraft for military purposes. They knew full well that in aircraft there was probably the most formidable military weapon of the future. And yet, addressing themselves as practical men to the problem, they found no answer to the arguments which had been set forth succinctly, but most forcibly, by the technical subcommittee.

The reason was, as had been well stated, that they were dealing in substance with facilities that were needed in the progress of civilization. They could not put a ban upon progress. They also knew, even if they prohibited all aircraft for military purposes and allowed the development of the art to meet the requirements of civil life, that in time of war the bases of that development would be immediately available and within a short time provisions would be made amply for any possible military uses.

The question, therefore, reduced itself not to one of limitation of armament but to a limitation of civil progress; and faced with that difficulty, there seemed to be no alternative but to adopt the first resolution so far as it applied, as it did apply, exclusively to heavier-than-air craft. This appeared to be the sense of the committee.

The Chairman then said that the next question was whether it would be deemed practicable to impose a limitation in the case of lighter-than-air craft. He asked to call their attention to what the subcommittee said with regard to this subject. The statement was very short, and it brought before them the point quite clearly, and, with their permission, he would read it. The subcommittee said:

"Many of the remarks already made apply to lighter-than-air craft, but, as in the case of commercial aircraft of this nature, limitation is both possible and practicable. It is unnecessary to recapitulate the argument that the military value of a dirigible is dependent on its size, and the size of dirigibles and the number maintained can be limited by agreement on a few simple rules. Infraction of such rules can be rapidly ascertained without detailed inspection. But such a limitation of lighter-than-air aviation forces would not effect a limitation

of this kind of air power of a nation unless a limitation were also imposed on its lighter-than-air commercial activities.

"The line of demarcation between the large commercial airship and the military airship is very slight, and a commercial dirigible would require little, if any, alteration in order to adapt it to military purposes. The objections to the limitation of the number or character of commercial lighter-than-air craft have already been remarked on."

Oppose Limiting Air Science

That allusion was, apparently, to the fact previously emphasized in the report, as follows:

"As regards the desirability of limitations the committee has touched on those factors which must be understood before arriving at a decision. It feels it to be a duty to lay great stress upon the following fact which will have a decided bearing upon any determination of the proper policy to be adopted; any limitation as to the number and character of civil and commercial aircraft, heavier-than-air or lighter-than-air, which is efficacious to hinder their utilty for war purposes, must interfere disastrously with the natural development of aeronautics for legitimate civil and commercial enterprises.

"To limit the science of aeronautics in its present state is to shut the door on progress. It is for the conference to decide whether the limitations which can with difficulty be devised and imposed are to be adopted at such a cost."

It was, therefore, practicable to impose a limitation, by agreement, upon the size of dirigibles. Questions as to limitation of number could be considered separately, but certainly it was practicable to impose a limitation upon size. The question was whether it was desirable to do so, in view of the fact that commercial dirigibles could be converted into military dirigibles and therefore the question was whether the advantage in the limitation of armament, that is, in having an agreed limit of size of dirigibles, was so great that it offset the disadvantage of limiting the size of dirigibles for commercial purposes. The Chairman presented that question for discussion.

No one desired to discuss the matter.

The Chairman then asked if it was the desire of the committee to state, as their conclusion, in view of the arguments presented by the sub-committee, that it was not practicable to impose limitations upon lighter-than-air craft, or if it was their desire to present a resolution containing such a limitation.

Senator Schanzer said that he only desired to ask the Chairman if the first proposal, which made an exception for lighter-than-air craft, were approved, might it not seem that the exception were approved also. He suggested the elimination of the words, "excepting in the single case of lighter-than-air craft."

The Chairman said the suggestion of Mr. Schanzer was that it would accomplish the purpose, if it was not proposed to put a limitation upon the lighter-than-air aircraft, to adopt the conclusion of the subcommittee, leaving out the last clause, so that the sense of this committee would be stated to be as follows:

"The committee is of the opinion that it is not practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military."

The Chairman said that it was suggested by Mr. Balfour that the words "at present" should be inserted before "practicable." That seemed to be a very good suggestion; because that was what they were doing—not indicating that in the future it would not become practicable. Then the resolution would read:

"The committee is of the opinion that it is not at present practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military."

He then asked for assent to this, and it was unanimously adopted.

The Chairman then said that they came to the next recommendation or conclusion of the subcommittee, as follows:

"The committee is of the opinion that the use of aircraft in war should be covered by the rules of warfare as adapted to aircraft by a further conference which should be held at a later date."

The subcommittee had taken occasion to review the difficulties, at the present conference, in adopting detailed rules of war.

MR. SCHANZER:

"We approve the proposal which aims at the convocation of a conference for the study of the rules of aerial warfare. But we believe, gentlemen, that certain principles of international law exist in relation to the use of aerial weapons, which deserve to be solemnly proclaimed today, by this same conference.

"Since we have accepted, for humane reasons, the prohibition of the use of submarines against merchant vessels, we feel it our duty now, in consistence with principles of justice and coherence, to put forward in our turn a proposal concerning the use of military aeroplanes and airships and of all other warlike means for the bombardment of open towns.

"Everybody recalls the horrors and atrocities perpetrated by the Germans and their allies during the last war, when open towns were bombarded with so large a sacrifice of the lives of non-combatants, women and children. In certain countries many towns suffered by such bombardments, which were a menace not only to the peaceful inhabitants, but also to historic buildings, to monuments, to immortal works of art which certain towns possessed, and which were the patrimony not only of the towns directly smitten, or of the nation to which the towns belonged, but of the whole of humanity."

ADMIRAL DE BON

Admiral de Bon fully endorsed the views of Mr. Schanzer. He recalled that Article 25 of The Hague Convention of 1907 prohibited the bombardment of unfortified cities in any manner whatever. During the late war, unfortified cities were bombarded not only by airplanes, but by land and naval artillery.

MR. ROOT:

Mr. Root said that there was some uncertainty or alleged uncertainty in the application of The Hague rule regarding the bombardment of undefended towns to the action of aircraft. Of course, when the rule limited bombardment to defended towns, when it prohibited the bombardment of undefended towns, it had reference to military or naval operations against towns that afforded military or naval obstacles to those operations, and as to those towns the provision was that the commander should notify the defended place so that the civilians might have an opportunity to withdraw. As to the undefended towns, he must not bombard them at all.

Now, those distinctions did not seem to fit bombardments from the sky. No town was defended against such bombardment. If the rule were strictly applied, it did not prohibit the bombardment of Paris, because of the fortifications surrounding Paris. It was a defended town. Most of the cities in Europe had some sort of defense.

He fully sympathized with the view which Senator Schanzer took. If the committee were going to act, he wished Senator Schanzer would apply his very acute intelligence toward making this rule more definitely applicable to the existence of circumstances of aircraft and a town defended as against land attacks but wholly undefended as against air attacks, and resolve the uncertainty that resulted from the fact that the rules were not made for air attacks. He thought the committee would render very useful service if it could do that, far beyond merely repeating a rule and leaving this uncertainty.

When one considered these two rules, that a defended town must not be bombarded without notice sufficient to enable the innocent—the women and the children and noncombatants—to withdraw and that an undefended town must not be bombarded at all; when one considered these two rules, the spirit of them could prevent aircraft from bombarding any town whatever. Bombard a railroad junction, a station crossing? Yes. Bombard a munition factory? Yes. But the centre of an innocent population? No, not under any circumstances at all. For that reason, Mr. Root concluded, the rule was inadequate, and if the committee were going to speak, they ought to make it adequate.

SECRETARY HUGHES:

The Chairman said there seemed to be general acceptance of the spirit and purpose of the proposal made by Senator Schanzer. It was obvious from the discussion that in detail the matter was one which, like other rules relating to war, would require the most careful and probably protracted consideration of a commission of jurists, in order that the new situations which had been developed should be carefully developed and rules framed with precision to meet them.

The Chairman said that the committee was now considering the recommendation of the sub-committee that rules of warfare should be considered by a further conference. He suggested for the consideration of the committee that instead of taking that course, provision should be made for the creation through the action of the powers here represented, of a commission of jurists, which should, at an early date, take into consideration the question of rules of war which seemed to be demanded by new exigencies and revelations or the adaptation of new instruments of warfare to the end that recommendations might be presented to the powers for their acceptance. The Chairman feared that a future conference, for example, dealing with a question of this technical character—technical in the sense that it would require very close study by jurists—would find itself much in the same position that the committee was in: It would have to wait until it was advised by legal experts.

Perhaps the best form that this could be put in, and the most practical action, would be for the powers here to agree to designate members of a commission of jurists, who should make a report and recommendation.

SIR ROBERT BORDEN:

Sir Robert Borden said that at the previous meeting he had made a suggestion on this subject. He was, however, quite content that what he had said then should be left for the consideration of the proposed future conference or commission.

Even a commission of jurists would find extreme difficulty in dealing with a question so complicated in nature. It was obvious that the present conference could not deal with it satisfactorily. Senator Root had observed that a railway junction or a munition factory might properly be subjected to bombardment. But inasmuch as modern warfare by its very nature involved all the energies of each nation engaged it would be found that railway junctions, munition factories and other such points of atack were everywhere scattered among the habitations of the innocent population.

Accordingly it would be necessary to consider how far and by what restrictions the bombardment of such points could be prevented and, on the other hand, to consider whether it would be feasible to prohibit absolutely any attacks on such war objectives. The subject was an entirely proper one for some future commission or tribunal, but it should be considered whether or not the establishment of such a commission would be appropriately confined to the five powers here represented.

SECRETARY HUGHES:

The Chairman replied that it was his idea that it should not be so confined, but that representatives of the five nations should initiate the project. He said that he supposed that a resolution for the constitution of such a commission of jurists would have to be considered most carefully in order that it should be framed with precision and that it might well be committed to the Committee on Drafting, with instructions to brng in an appropriate resolution to the end sought.

It might be sufficient now to declare the adherence of the committee in principle to this, that nations here represented should provide for the appointment of a commission of jurists to consider the rules of war which were affected by the events of the late war, and also require investigation in the light of the development of new agencies of warfare; and he would ask if there was any objection to adherence to that principle, leaving the precise resolution to be formulated by the Committee on Drafting.

MR. BALFOUR:

Mr. Balfour said that he thought the Chairman was well advised in saying that this matter should probably be considered a little more closely than it was possible to consider it on an occasion like the present or in the present assembly. Therefore he welcomed the view that the matter should go before the Drafting Committee. He had, however, two suggestions to make which he hoped the Drafting Committee would consider. The first that it would be most inadvisable in his opinion, to limit the matter to jurists.

That was a point which concerned not merely the framing of the law or the mode of fitting into the general tissue of our system of international law any new laws or rules that might be devised. For that purpose, no doubt, jurists were essential, and jurists should play a very great part in any inquiry such as that now proposed. But, after all, the people who had seen those instruments at work, who knew what those instruments had involved in the past and what they were likely to involve in the future, should have more to say in regard to the framing of such rules than the most expert authority upon international law. He thought that they should play a not less important part in any inquiry which was made on the subject.

He (Mr. Balfour) did not know whether his second suggestion would meet general approval, but he would very much like to see the area of inquiry reasonably limited. International law, and especially international law dealing with the laws of war, was extraordinarily complicated. He could not deny that it ought to be dealt with and he could not see how anybody could deny it. For himself he could not refuse to accept the proposition that the mere fact of development of methods of warfare carried with it an almost inevitable corollary that the rules of warfare should be revised.

But that subject was so complex and so enormous and was so certain to lead to much difference of opinion within the committee of experts and jurists that he would like to divide such an inquiry into two parts. The part of the general inquiry in which they were most interested, which had most usefully occupied some of the attention of the conference, was really adequately described in the list of the agenda which the Chairman had brought forward on behalf of the Department of State at the beginning of their labors. Among the subdivisions on the subject of limitation of armaments there was the following sub-heading: "Rules for the control of new agencies of warfare."

It seemed to him if the conference would limit, at all events in the first instance, the work of the mixed committee of experts and jurists to rules for the control of new agencies of warfare, they would be more likely to come to a speedy conclusion and much more likely to obtain a conclusion which would be unanimously adopted. He, therefore, suggested for the consideration of all his colleagues round that table whether that humbler but still all-imporant subject would not be sufficiently wide in its scope to occupy the attention of even the most powerful committee which they were able to provide for its investigation.

SECRETARY HUGHES:

The Chairman said there was great force in the suggestions made by Mr. Balfour, and he personally, had not the slightest objection to their adoption. It was not at all the intention that this proposed commission should consist of jurists who would work in disregard of the recommendations of technical experts. He supposed that the jurist representing each country would be advised very fully of all technical matters by both naval and military experts, but when it came to the point of formulating the legal rules which should be adopted, it would require the special training of jurists in order that the information and advice and proposals furnished by military and naval experts could be adequately considered and those which were adopted suitably expressed.

There was not, however, the slightest objection to having the commission itself enlarged, if that would seem to be desirable. He had found, however, that when it came to a question of drafting rules, the fewer there were who were actually engaged in the work the better the prospect of success; and while each one charged with the responsibility should have all the information available and the aid of all the experts who could possibly throw light upon the subject, a very few men competent in drafting, associated together for that purpose, could accomplish much more than a large committee.

He also felt the force of the suggestion of limiting the scope of inquiry. That was very carefully considered when the tentative agenda was suggested, and the proposal made to which Mr. Balfour had referred.

It seemed to the Chairman that the question of the method of constituting the commission and the scope of the inquiry to be entrusted to it could well be committed to the consideration of the Committee on Draft and the committee could await their recommendation. If that was agreeable to the delegates, he would simply ask assent in principle to the constitution of a commission for the purpose of dealing with the subject of rules of warfare in the light of the development of the recent war.

Mr. Balfour said that while he was perfectly ready to have the matter referred to the Drafting Committee, he would like to make reservations limiting the scope of the Drafting Committee's work, and asked the Chairman's advice as to how this result might be attained.

The Chairman assumed that both of the suggestions Mr. Balfour had made should be deemed as referred to the committee and that they would take those into consideration as well as others that might be advanced in the course of their discussion, and that the committee should bring in a recommendation, which could then be discussed in the light of the arguments they advanced for its support.

Mr. Balfour said that would be satisfactory.

After a vote was taken, the Chairman announced that the suggestions as to the reference to the Drafting Committee were unanimously approved.

Thereupon the committee adjourned.

AIR LINES AND SOME OF THEIR PROBLEMS

By R. B. C. NOORDUYN, New York, N. Y.

(Paper presented before the American Society of Mechanical Engineers)

THE air lines in operation in Europe since 1919 have proved a great attraction for Americans who have formed, in fact a surprisingly large percentage of the passengers carried. The favorable impression which they invariably bring home of the new method of travel encourages the belief that once air lines are running in this country and can promise to equal the performance of those with which the traveler has become familiar abroad, public support will be forthcoming to a greater degree than has been generally anticipated.

In the United States last year, the mileage covered by commercial or privately owned aeroplanes was estimated by the Manufacturers' Aircraft Association, from reports received from operators all over the country, to be not less than six million miles, in the course of which some 225,000 passengers were carried. The Frenchman, who is accustomed to using a time-table for the next plane for London or Amsterdam, and buying his ticket at the nearest travel bureau, looks at these figures and thinks that the air lines in this country must be doing a good business. If this large mileage were actually covered in the operation of scheduled services over fixed routes, instead of in unorganized short flights, we could indeed consider air travel to be an established factor in everyday life.

As a precursor of regular services the present volume of flying must not be underrated. Its educative value is very great as the passengers carried on short flights now will be the patrons of the air lines of the future. Further, personnel, pilots, and mechanics are being trained, and ground organization, landing fields and service stations are being developed all over the country, although slowly and on a modest scale.

What, then, are the difficulties which have so far stood in the way of rapid development of regular inter-city air lines in this country?

Briefly, the aeroplane finds itself today in that stage through which many new inventions have passed, and in which the article itself has reached a more advanced state of development than the facilities and accessories necessary for its completely effective use.

The modern commercial aeroplane has all the qualities requisite to passenger vehicles generally, whether land, sea, or air going, with the addition, naturally, of a few of its own. As for comfort, passengers are seated in chairs similar to those in Pullman car, in cabins easily entered through full sized doors a step or two from the ground, protected from wind, cold and engine smells. They view the scenery through large windows. The motions of an aeroplane are far more gentle than those of any other vehicle, while sense of speed and vertigo are entirely absent in straightforward flying and there is no dust or dirt.

Safety and reliability under organized operating conditions are now such as to justify anyone in entrusting life and property to the air; according to the latest time-tables the regular passenger and freight lines in Europe are covering 22,000 miles per day. Table 1, a summary of British Air Ministry weekly reports on the traffic between London and the Continent, shows some interesting figures. On the three routes operated, 3088 flights were started during the first 10 months of 1921, of which 91½ per cent. were carried out in good order, which represents a distance of 700,000 miles flown and at least 6200 starts and landings made without one single passenger being hurt seriously. These figures are the more remarkable when taken into consideration with the very unfavorable weather conditions for which the region of the English Channel is notorious.

The United States Air Mail Service, which is operated over a series of route sections somewhat shorter in average length than the European lines, completed 95 per cent. of the 6690 flights attempted during the first 9 months of 1921, in the course of which 1,332,000 miles were flown with mail. On the Cleveland-Chicago section the twenty-fifth successive week of 100 per cent. performance was recently reported. However, it must be remembered that the Mail Service is supplied with a far greater number of aeroplanes and engines in proportion to the length of its routes than any private company striving to operate at a profit could afford, and also that, when carrying mail only, flights often can be successfully carried out under conditions which would be incompatible with the safety of passengers. The figures given do not, therefore, provide a satisfactory basis on which to judge the relative merits of equipment and personnel between the U. S. Air Mail and the European passenger lines, so far as regularity of performance is concerned.

Finally, in judging the present status of the aeroplane as a means of transportation, the all-important question of operating cost must be considered. The first air lines started operations hopefully, on the assumption that their small first outlay, on the purchase of converted war planes at a fraction of the manufacturing cost, and the supposed imperative demand of modern business for speed above all things, would insure at least a paying business from the beginning. How sadly they were disappointed is clearly shown both by the history of the companies concerned and the rapid, if not yet quite complete, disappearance of these machines from the chief airways of Europe.

Large numbers of 3-seater machines, converted fast day bombers, were in use during the first year or two after the war, which showed a dead financial loss on every trip, even when loaded to full capacity, which was by no means always the case. Large twin-engine bombers, capable of carrying about 10 passengers, solemnly ploughed their way daily between London and Paris and London and Brussels, more often than not less than half loaded, and at a prohibitive cost in gasoline and oil for their big engines. The fares charged had to be very high and the vicious circle was complete.

The technical results,—mechanical reliability and ability of the pilots to make their way in bad weather in spite of the rather primitive meteorological and other ground services available at that time were surprisingly good, but the financial results were disastrous.

It was not until the French Government heavily subsidized the French lines and enabled them to make a cut of 40 per cent. in their rates, that traffic began to increase; with this assistance, the old war types, uneconomical as they are, took on a further lease of life in France and are still widely used in that country. To enable the British companies to compete, the British Government assisted them by financing the acquisition of modern commercial planes on a repayment basis, and guaranteed a profit. The effect of these steps on the traffic itself is well shown by Table 1. In the meantime the principal constructors had given their serious attention to the problem of increasing the carrying capacity and reducing the running costs and the new machines showed a remarkable improvement in this respect.

It is interesting to note the successive steps toward this realization of the chief commercial requirement, the carriage of greater loads at less expense. Just before the dissolution of the pioneer concern—The Aircraft Travel & Transport Co. —a desperate effort was made to improve matters in this respect. Operations were placed in the hands of traffic experts pure and simple, who, quite justifiably, at once tried to increase the service obtained per week from the equipment in hand, such as it was. Undoubtedly this effort provided a vast amount of data on constructional details such as accessibility of engine installations, ease of repair and all matters which would become especially prominent as more work in a given time was demanded of each aeroplane as a unit. The results only emphasized more respects in which the coming commercial designs had to show improvement over the converted war types, aside from carrying capacity and load space.

The requirements having thus become clearly established, the designers set out to fulfill them. After the 360-hp. DH16, really a converted DH4, carrying four passengers in very cramped quarters, and subsequently the Bat, FK26, which carries a slightly greater load with the same horsepower in a good-sized cabin, this progress in design was very marked in the 450-hp. DH18, carrying eight passengers, which was very soon followed by the Fokker monoplane with five passengers for 185-h.p.. With these the useful load carried per horsepower had advanced from 4 lb. to 8 lb., or an improvement in commercial performance of 100 per cent. The internally braced monoplane, in which the aeroplane finds itself practically reduced to its essential parts, lifting surface, body, chassis and controlling organs comprising the entire structure of the machine, has opened up fields of study in the matter of wing design which promise still further progress in this direction. Within recent months several new designs on this principle have appeared and are in successful operation, which again show an advance in carrying capacity. Notable among these are the new DH29 and the new Fokker F4, which carry from ten to twelve passengers and considerable baggage with engines of 400-450 h.p., the useful load carried per h.p. thus having now advanced to 9 lbs. Roughly, this means that such aeroplanes can carry a load of more than one ton in passengers and freight a distance of 600 miles in 6 hours at a fuel cost of $48, or ¾ of a cent per passenger mile.

The few figures given go to show that the aeroplane, even in its present state of development, is by no means a hopelessly costly means of transportation, provided that facilities for its exploitation are developed to a sufficient extent so as not to entail the addition of entirely disproportionate overhead charges to the actual running cost, charges of a character with which no other form of transportation has to contend or is able to bear. In the following paragraphs a few of the factors governing these charges are discussed.

The Selection of Routes

What has been said gives an indication of the aeroplane's present capacities and also of the trend of development in the near future. The next question is, obviously, where can it be put into regular service with a reasonable expectation that that service will become truly a public utility and receive sufficient support to thrive as a commercial venture?

It may be argued that eventually air traffic will have its place in the scheme of things alongside the older and slower means of transit, wherever traffic of any kind—or at least long distance traffic—exists. However, it is obvious that in choosing the routes to be operated during the introductory period

very great care will have to be taken to select those on which the air lines are likely to justify their existence within a reasonably short time. Such routes may be fairly clearly divided into two categories. First, there is the route between commercially or politically important points, of which the development has been so rapid that transportation facilities have been unable to develop proportionately. The new world is full of such opportunities for the aeroplane, the only vehicle which is practically independent of geographical obstacles and does not entail the laying down of a permanent right of way.

Second, there are routes on which terrestrial transportation facilities are very highly developed and the volume of traffic very great, but where at the same time communication is retarded by natural obstacles which do not affect the aeroplane to any considerable extent. Chief among these are mountains and intervening stretches of water entailing either transshipment or circuitous routes.

In either case, the decision that the establishment of air communications is a justifiable venture can only be made after careful study of existing transportation facilities and local conditions. The full support of the foremost industrial and business interests in and around the terminal cities must be obtained; and extensive preliminary canvassing and propaganda work are essential with a view to enlisting coöperation by the community in the establishment of air terminals and other facilities analogous to those provided for shipping, as well as to insure patronage once the air line is in operation.

The public has to be taught how to use the airways; even with air lines in full operation a great deal of publicity work and effective advertising will be necessary to show the business man just how to combine the new transport facilities with the older ones in order to take full advantage of the aeroplane's speed. This is especially the case as long as night flying is not practicable, or rather, not organized and regularly carried out, thereby necessitating the coördination of train and air-service schedules for long distance transportation.

Especially in the early days, the European lines suffered from lack of appreciation of the value of this educative publicity, a fact which contributed immeasureably to their difficulties in obtaining satisfactory loads. Both by this example and the far greater development of the science of advertising in this country, the coming American lines should have a considerable advantage over the European pioneers in this respect.

In the establishment of the first lines many similarities to the early days of railroading will be found, but many of the trials of the latter, both technical and financial, may be avoided. Compared with the railroad, the capital outlay involved in the airline is fractional; the non-requirement of permanent tracks involving the possession of immense tracts of land, will always be among the chief advantages the aeroplane possesses over any other means of overland transportation.

Ground Organization

Nevertheless, real estate values effect the increasing commercial use of the aeroplane to a considerable extent. There is probably no other single factor which has been so effective in retarding the general use of aircraft in this country as the lack of landing fields. Such privately owned flying fields as there are, are in only too many cases small, with obstructed surroundings and inadequate for highly loaded commercial craft. The military fields, which in Europe form the backbone of the airways, are few in the U. S. even including those abandoned after the war; also they are generally located just where the ground happened to be naturally suited for training in flying, far removed from large cities. In Europe important centers were liable to attack by enemy aeroplanes and defensive squadrons had to be stationed close at hand. Even in the case of the European capitals, however, the airports now established on these old military fields are in most cases much father away from the cities than is desirable for commercial flying. If two hours have to be spent in transportation to and from the airports, in order to make a 2½-hour journey by aeroplane, the saving of time over the railroad, at least where the latter provides an efficient and direct service, is practically lost, and the airline is not likely to flourish.

This problem is admittedly in most cases difficult of solution. The nearer the center of a town, the more valuable land becomes; however well financed, the cost of such land suitable as an airport is not one which a new transportation company, which has yet to develop a popular demand for its service, can be reasonably expected to bear. The analogy with docks and harbors, of which the intial cost is borne by the city treasury, is obvious, but it also demanding much from a city's foresight and enterprise to expect it to lock up a great amount of capital in reserving large tracts of valuable land near the business center, of which—especially at first—very scant use will seem to be made. As traffic develops, increased landing fees, hangar rents and other dues will improve the immediate financial aspect, until the time, which may not be so far distant as to be visionary, that long distance airliners will land on platforms covering the stations, yards and part of the tracks of the local railroad lines or even several city blocks.

To a layman, it would seem that in this question of reserving centrally located tracts of land as airports for a number of years there may be much to interest real estate manipulators.

The arrangement of emergency landing fields at short distances apart, along the routes, should not present any difficulties. Their preparation may involve the removal of a few trees and other obstructions and the erection of suitable markings as a guide for pilots when in difficulties due to weather or mechanical trouble, but otherwise they can retain their normal functions if meadow land is selected.

A most important part of the ground organization is the provision of a specialized and adequate meteorological service. A considerable development of the existing Government meteorological institutions or weather bureaus will be necessary, since the information obtainable at the present time is of very little use for air navigation. In Europe, government weather experts and radio services are installed on the principal airports, and reports are obtainable hourly. In England it was so well recognized that air navigation was bound to develop the knowledge and organization of meteorlogical work, that shortly after the war the existing government meteorological office was placed compeltely under the control of the Air Ministry.

Such further auxiliary services as directional radio and beaconing the airways by night will eventually all have to be recognized as a public service and undertaken by the Government; the pooling of facilities by different railroad companies may be a matter of private arrangement and not the concern of the public, but the following of organized airways and the picking up of radio signals will automatically become a public right.

Legislation and Insurance

As is the case with any form of transportation, the perfection of organization, mechanical reliability and standing of personnel ought to be reflected clearly in the terms on which equipment passengers and freight are accepted for insurance by the large companies, and it may be fairly regarded as illustrative of the condition of commercial flying in this country that the state of affairs in aircraft insurance is far from satisfactory.

At present the position of an insurance company called upon to quote on aircraft risks is not enviable. The entire absence of any legislation to place responsibility for even the most elementary consideration of public safety, by controlling the efficiency of aircraft and ground organization, combined with the scarcity of such ground organization in the form of landing fields and auxiliary services, would induce any company to keep clear of taking aviation risks for the present, were it not for the necessity of obtaining experience and statistics as a basis for the business which the development of air transportation on a large scale will eventually offer. As it is, the present state of the aircraft insurance market may justifiably be described as chaotic. Again, risks have been accepted which should never even have been considered, and the consequent losses duly paid, while on the other hand premiums have been quoted which must have been based on a considerable "factor of ignorance," being, apparently, out of all proportion to results already obtained elsewhere under conditions sufficiently similar to those involved in the proposal.

The institution of a system of registration and inspection of aircraft and pilots by the Insurance Underwriters Laboratories is a great step in the right direction. To make the system fully effective, it is to be hoped that legal confirmation of the powers of that body will soon follow. The assignment of such technical duties to a semi-public institution, instead of to a Government department—which principle has a strong precedent in the case of shipping in Lloyds—is in many respects preferable. The rapid development both of the aeroplane and its application may necessitate frequent and urgent changes in existing regulations, with which necessity it will be difficult to keep pace if technical details are incorporated in Federal laws.

The effect which proper legislation will have on the financial stabilization of air transportation in general, both through the creation of reasonable insurance facilities and through the definition of the legal status of the aeroplane and that of its operators, is well illustrated in the case of passenger liability. When legal liability for the safety of passengers and third parties is determined, insurance against these risks will become possible. At the present time the risk cannot be deter-

(*Concluded on page* 503)

TRAFFIC AIRSHIPS WITH SPECIAL REFERENCE TO ECONOMY[1]

By WALTHER LEYENSTETTER

Translated by the National Advisory Committee for Aeronautics

AS a result of the progress in the construction of airships during the War, the question naturally arises as to their adaptability to economical transportation.

The airship is expected to enter into competition with the existing means of transportation and to carry on air traffic along with the aeroplane.

In a general way, the following table shows the available fields for aircraft:

Conveying Medium	Water	Land	Air	Electricity
Realm of Transportable weight	20,000 Tons	800	20	
Speed Realm	km/h 5 50	20 150	100 200	1080000000 Km/h
	Boats propelled by muscle, wind or enginepower.	Passenger cars or trains with or without rails.	Without general economic significance. Only for difficulty accessible points without other transportation lines for urgent delivery of samples, etc.	
Passengers	Ditto	Ditto	Airplanes: for communication between places where especially quick travel is necessary or where the ship cost of building other lines is too high. Airships: the increase in speed over land or ship travel is great enough.	
News	Mail	Mail	Air mail, as above for freight and passengers.	Telegraph, Telephone

It follows that air transportation constitutes an organic extension of land transportation, but without the load exceeding 20,000 kg. and without materially reducing the great jump in speed from 150 km/h (electric express) to 1,080,000 km/h (telegraph).

It can therefore seldom be a question of ordinary freight, but chiefly of passengers, urgent letters, samples of goods, etc.

An aircraft line is consequently always able to compete, when it utilizes its advantage (shared in common with boats) of saving the expense of construction and upkeep of railroads.

Their ability to compete is unimpaired when their superiority depends only on the shorter duration of the trip, in connection with which the element of danger and dependence on the weather works to their disadvantage.

Technical Viewpoints

1. Flight Altitude and Efficiency

The propeller thrust P, for a given engine power N_1, is

$$P = \Psi \cdot \pi \cdot r^4 \cdot w^2 \cdot \frac{\gamma}{8} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$N_1 = \mu \cdot \frac{\pi}{75} \cdot r^5 \cdot w^3 \frac{\gamma}{g} \quad . \quad . \quad . \quad . \quad (2)$$

in which μ and Ψ represent numbers dependent on $\frac{v}{r \cdot \omega}$

r, the propeller radius in m,
ω, angular speed in 1/s,
γ, air density in kg/m^3.
g, acceleration due to gravity in m/s^2.

[1] Taken from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," October 30, and November 15, 1920.

This thrust equals the total resistance of the aircraft.

$$W = (\Sigma\, \zeta_w \cdot F + \Sigma\, \xi_w\, J^{2/3}) \frac{\gamma}{g}, v^2 \quad . \quad . \quad (3)$$

in which

ζ_w, represents the drag coefficient for surfaces,
F, the frontal surface in sq. m.,
ξ_w, drag coefficient for objects,
$J^{2/3}$, total surface in sq. m.,
v, speed of aircraft in m/s.

If the engine power N_1 and the aircraft speed v remain constant, it follows since all other quantities[3] are invariable and γ/g only appear linearly in equations 1, 2, and 3, that under these conditions the flight altitude of the aircraft makes no difference (with ordinary engines).

For engines with ordinary carburetors, the power diminishes more rapidly than the air density as was found by experiments in the vacuum chamber.[4] For these engines there was a connection between horsepower and air density, according to the equation:

$$N_e = \sqrt{n \cdot \gamma - m} + o \quad . \quad . \quad . \quad . \quad . \quad (4)$$

in which n, m and o are known.

Overdimensioned and high compression engines lie at an altitude of 2500 m. The variations in consumption are so small up to 3000 m. that, from the standpoint of efficiency and fuel economy, high compression engines are the best for airships.[5]

The endeavor to maintain the greatest possible economy of fuel, independently of the air density, is manifested by its reaction on the propeller.

To obtain the highest propeller efficiency is less important

[3] This does not hold quite true for ζ_w and ξ_w. Since, however, tests have not yet been made of the changeability of these two values for changing v/g and it may be assumed that Ψ and μ change in quite similar manner, they may be here regarded as constant.

[4] See "Zeitschrift des Vereines Deutscher Ingenieure," 1919, Vol. 63, W. G. Noack, Airplane Superchargers, p. 995 (For translation see N. A.C.A. 3161-32), and T. B., Vol. III, No. 1, pp. 1-10. (For translation see N.A.C.A. 3001 Daimler /2).

[5] See "Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1920, No. 10, p. 137, "Der Flugmotor in Verschiedenen Luftdichten," by O. Schwager, and "Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1920, No. 13, p. 185, "Hohenleistung von Verbrennungsmotoren," by Wilcke.

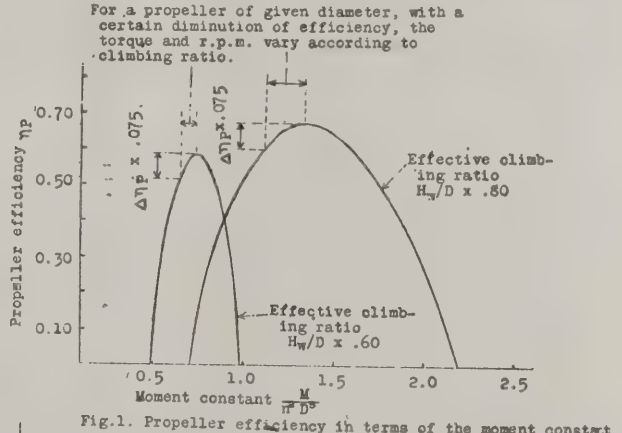


Fig.1. Propeller efficiency in terms of the moment constant.

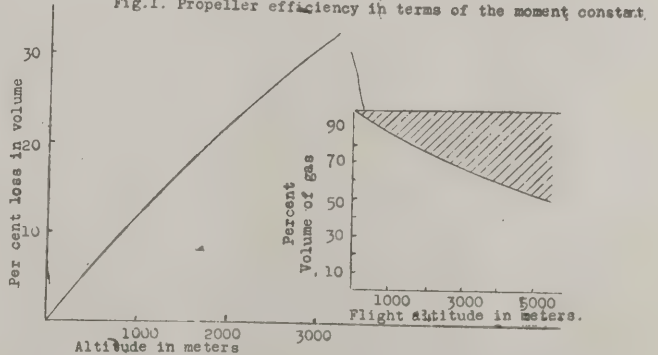


Fig. 2.Utilizable volume of gas dependent on the flight altitude.

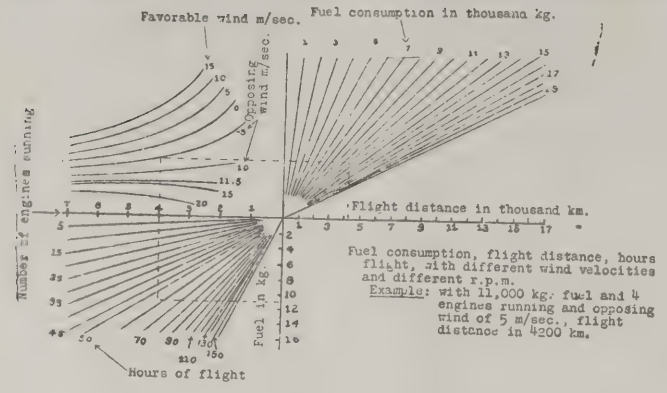


Fig. 3.

in itself than to adapt the propeller output to the working conditions of the engine.

The influence of the variations in torque and r. p. m. on the efficiency of propellers is shown by Fig. 1, which is taken from the publications of Schaffran ("Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1917, pp. 49, 93 and 109) on systematic propeller experiments.

From this figure it is manifest that if the revolution speed n, and the diameter D are constant, then the efficiency πp is greatest for a given torque M.

The field within which πp changes by like amounts, constantly increases with the effective climbing ratio H_w/D. When, therefore, the revolution speed n and the diameter D remain constant, it is advantageous to take the effective pitch and therewith the speed vr as great as possible, since with a large H_w/D the absolute value of the propeller efficiency πp increases, as also with decreasing engine power, $L\ (M = \frac{N}{n} 71620 - \pi p$ decreases less than with a small H_w/D (narrow-bladed propellers).

For small variations in the r. p. m. and in torque, the decrease in propeller efficiency is of subordinate importance.

The increase in the r. p. m. of the propeller, due to increasing air density with constant engine power, demands however special measures.

The variation of the propeller speed through

(a) a variable gear-shift, has the disadvantage of increased weight, considerably more noise and objectionable acceleration of the propeller in thin air.

(b) regulation of the engine speed, has the disadvantage of increasing fuel consumption by departing from the most favorable r. p. m., and of vibrations of the whole engine group on approaching the critical r. p. m.

The most promising method is by changing the pitch of the propeller[8] in order, with changing air density, to retain approximately the same efficiency.

Tested specimens of adjustable blades designed by Helix, Hirth, Lorenzen and others have demonstrated their practicability and the possibility of making them of other materials than wood.

While an aeroplane in climbing requires an increase ΔL in the engine output per second

$$\Delta L = G \sin \Phi \cdot v_s \quad . \quad . \quad . \quad . \quad (5)$$

in which G = weight of aeroplane,

Φ = climbing angle,

v_s = climbing speed,

an airship has a constant lift up to a certain altitude. The choice of this altitude has a bearing on the percentage composition of the gas at the starting point.

In accordance wih the barometric altitude formula, without reference to temperature changes, we have:

$$H^1 - H = 18{,}400 \log \left(\frac{1}{1 - \frac{V^1}{V}} \right) = -8{,}000 \log \text{nat} \left(1 - \frac{V^1}{V}\right)$$

in which $H^1 - H$ is the difference in altitude up to which no blowing off shall occur,

V, the gas volume at beginning of ascent,

V^1, increase of gas volume at altitude H^1,

hence $V + V^1$, total gas volume of airship.

[8] Article by Prof. C. Eberhardt in "Motorwagen," 1919, p. 309, on adjustable propellers.

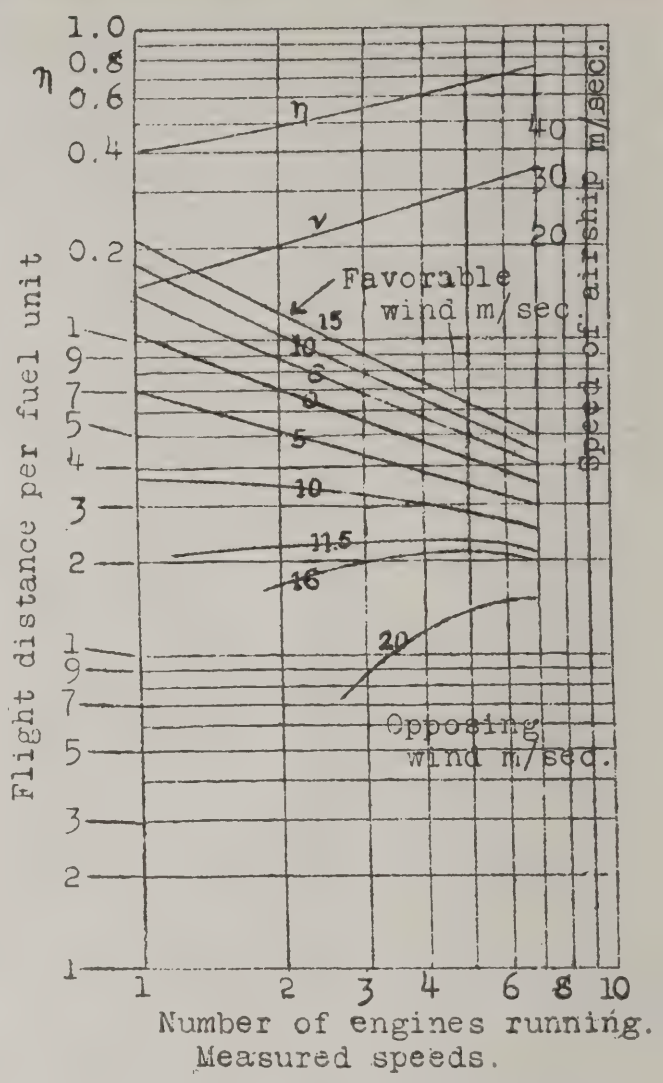


Fig. 4 measured speeds.

From the above equation follows

$$\frac{V^1}{V} = \frac{H^1 - H}{8000} - \frac{(H^1 - H)^2}{8000^2 \cdot 2} + \frac{(H^1 - H)^3}{8000^3 \cdot 6} - \frac{(H^1 - H)^4}{8000^4 \cdot 24} + \quad (6)$$

$H^1 - H = 500, 1000, 1500, 2000, 2500, 3000, 4000, 5000$ m.

$\frac{V^1}{V} = 6.06, 11.77, 17.1, 22.1, 26.8, 31.3, 39.3, 46.4\%$

Fig. 2 shows the utilizable gas volume in terms of the flight altitude. A partially inflated airship always has the same supporting power both in ascending and in descending. A full airship loses about 1% of its total lifting power for every 100 feet of ascent. Mechanical aspect of a full airship is always uneconomical, resulting in a loss of both fuel and efficiency.

With reference to engine power and propeller efficiency, as well as for avoiding needless loss of gas, we are restricted to a maximum difference of about 2500 m. between the starting and flight altitude.

2. Flight Speed

The necessity for war aircraft to reduce the air resistance, has exhausted the possibilities so far that the limits in the practical production of streamlined coverings and in the accessibility of important parts are rather to be sought, than the elimination of drag-producing bodies.

The case is similar as regards weight reduction. Still there are possibilities here for improvements in the further development of girder construction, the employment of more suitable materials, etc.

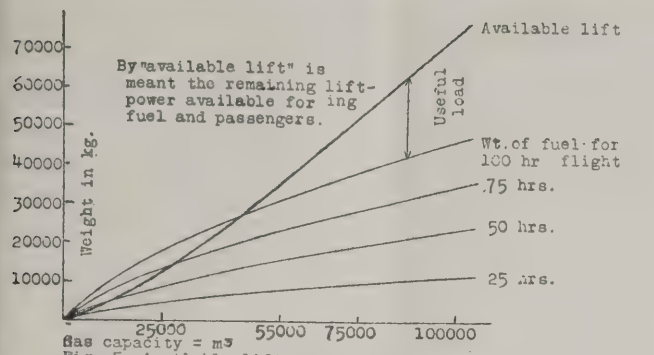


Fig. 5. Available lift, useful load and weight of fuel for rigid airships.

The connection between weight and drag, if aircraft of like speeds are compared, is determined by the saving in power for a lessening in drag. In general it is

$$W = \frac{75 \cdot N \cdot \pi}{v}$$

in which W = drag of aircraft,
v = speed of aircraft,
N = total engine power,
π = efficiency of aircraft.

With constant aircraft speeds, the horsepower of two aircraft may be compared by the formula

$$N_2 = \frac{W_2}{W_1} N_1$$

in which

$$W_2 < W_1$$
$$v_2 = v_1$$

If G_{bo} is the fuel and oil consumption per HP and per hour, and t is the flight time in hours, then the fuel saving for any drag diminution is given by the formula

$$\Delta G_{bo} = G_{bo} \cdot N_1 \cdot t \left(1 - \frac{W_2}{W_1}\right) \quad . \quad . \quad . \quad (7)$$

It is here assumed to be a question of only small changes in drag and that, in throttling the fuel, only an insignificant loss of efficiency of the engine occurs.

If then $W_2 > W_1$ and $v_2 > v_1$, the increase in fuel consumption with increased aircraft speed is

$$\Delta G_{bo} = G_{bo} \cdot N_1 \cdot t \left\{ \left(\frac{W_2}{W_1}\right)^{3/2} - 1 \right\} \quad . \quad . \quad . \quad . \quad . \quad (8)$$

If we wish, with traffic aircraft, to adopt an arrangement which, with small space for passengers and freight, will enable the reduction of the total drag, the question arises as to whether, in the particular instance, it is more economical to reduce the flight time or the weight of fuel.

It follows from the above that (for a small reduction in drag, resulting from the saving in fuel due to the engine) it is economical to throttle the engine.

These considerations lead in general to the inquiry, in the case of streamlined bodies, as to what relations there are between content J, surface O, and drag coefficient ζ_w.

The investigations of Prandtl-Fuhrmann, which must be considered fundamental, are based on models having the same cubical contents and the same surface (Hütte I, 1915, p. 359).

From a purely theoretical point of view, the best shape would be that offering the least total resistance for a given capacity. Nevertheless the spindle-shaped body with the best drag coefficient is not the most favorable for the construction of an airship. According to whether it is rigid or non-rigid, it must be determined when, with a constant capacity J, the surface O (for non-rigid) and the weight G_s (for rigid airships) is the smallest. Above all else, its controllability and matters pertaining to the hangar play the deciding role.

For ascertaining the most favorable flight speed[1] it is necessary, for the sake of economical operation, to be able to change the aircraft speed at will, without loss of power. Such speed changes are effected through switching individual engines on or off.

The attempt to calculate the distance flown with different numbers of engines running, on the assumption of unvarying efficiency, offers no prospect of success, since π (as shown by Fig. 4) is greatly affected by changes in the speed of the aircraft.

[1] P. Renard, Les voyages economiques en aéronef (La technique aéronautique, 1910, Vol. 11, p. 1) and C. Wieselsberger, Göttingen (Zeitschrift für Flugtechnik und Motorluftschiffahrt," 1913, p. 16) have drawn the power curves in terms of the aircraft speed and determined graphically the most favorable flight speeds.

3. Distance Flown and Useful Load

The expression of the useful load with reference to the distance flown is derived from Professor Parseval's formula.

If the drag-weight ratio of the aircraft is K^1 (ratio of drag W to weight G), then $W = K^1 G$.

It has been found that 1/8 may be assumed for a good aeroplane. With a propeller efficiency of $\pi p = 0.75$, the work done by the engine during a flight s is:

$$A = s \cdot G \cdot 0.167$$

Now one HP generates 270,000 kgm/h = 0.27 kmt/h and consumes about 0.25 kg/h of fuel and oil. Hence for generating 1 kmt we require $\frac{0.25}{0.27} = 0.93$ kg with a throttle loss of about 1 kg of fuel. The fuel consumption

$$B = s \cdot G \cdot 0.167 \cdot 1 = s \cdot G \cdot 0.167 \text{ kg.}$$

The fuel consumption during flight results in a loss of weight d G:

$$-d G = G \cdot d s \cdot K \quad (K_{\text{aeroplane}} = 0.000167 \text{ for G in tons}).$$

Hence

$$s = \frac{1}{K} \cdot ln \left(\frac{G_o}{G}\right)$$

in which G_o = weight of aircraft at start,
G = weight of aircraft at finish.

If the fuel load is placed at 20% and the useful load is likewise placed at 20% of the total weight, then the distance flown by the aeroplane in still air is $s_{\text{aeroplane}} = 1380$ km (which is a very favorable calculation).

In the case of an airship, W is constant.

With a propeller efficiency of $\pi p = 0.75$, the work done by the engine for the flight distance s is

$$A = \frac{s \cdot W}{\pi p}$$

and the fuel consumption

$$B = A \cdot 1 = 1.33 \cdot s \cdot W \text{ kg.}$$

If we take $\frac{1}{32.5}$ as the ratio of drag to total lift, then with a fuel load equal to 20% of the total load, the distance flown by the airship will be s = 4880 km.

Since, however, we have the ratio

$$\frac{\text{total lift}}{\text{own weight}} = \frac{100}{40}$$

with the unfavorable system of the rigid airship for useful load, 30% and more can be reserved for fuel. (For 30% fuel load, $s_L = 7330$ kg).

The drag of an aeroplane is generated chiefly by the supporting surfaces. Any considerable improvement in the ratio of the drag to the weight is therefore not to be expected through enlargement of the dimensions of an aeroplane and any increase in its economical radius of action in this manner does not appear possible.

If we now consider the radius of action of airships, the comparison of useful load and fuel load for rigid airships in Fig. 5 shows immediately that on long voyages an extraordinary decrease in weight results from the consumption of fuel.

For example, it amounts to 15,000 kg. for a 55,000 cu. m. airship in 50 hours of flight. As a result of this lightening, the airship climbs

$$\Delta H = 18{,}400 \log \left(1 - \frac{g}{G}\right) \text{ meters}$$

in which g = loss in kg.
G = total weight of airship in kg.

$$\Delta H = 18{,}400 \log \left(1 - \frac{15{,}000}{64{,}000}\right) = 1620 \text{ meters.}$$

If the equilibrium altitude were 2500 m. on starting, the loss of gas in climbing 1620 meters higher would amount to

$$0.145 \cdot 55{,}000 = 8000 \text{ cu. m.}$$

The avoidance or diminution of this loss of gas resulting from the fuel consumption constitutes an important problem in solving the question of airship transportation in the economical sense.

As a means of obtaining ballast, we have the air, the exhaust gases, and the fuel itself at our disposal. The utilization of the air and the moisture it contains for obtaining ballast is impracticable, on account of the apparatus required and the often small proportion of moisture present.

From the combustion of gasoline and benzol, water and carbon dioxide are obtained. These combustion products

must be reduced to a minimum volume and normal temperature before they can be utilized as ballast.

Without going into the details of the known chemical and thermodynamic processes within the engine, we can call attention to the normal heat balance of an airship engine:

25.75% useful energy,
24.50% radiator water loss,
39.80% exhaust gases,
3.50% radiation,
6.45% friction and change of form.

From one kilogram of fuel 0.69 to 1.8 kg. of combustion water can be theoretically obtained (1 kg. C H yields theoretically 1.46 kg. water at 15°C and 760 mm. Hg.). Practically, with a variation of the air excess between 10% and 20%, we can expect to obtain about 90% of the theoretical combustion water.

The calculation of a plant for recovering the water contained in the exhaust gases is based on the normal radiator dimensions. The relative radiator efficiency decreases with increasing flight speed.[8] The drag of the radiator and the velocity of the air through the radiator are diminished by an air scoop placed in front of the radiator.

The airship drag W (equation 3) is:

$$W = \frac{75 \cdot \pi \cdot K \cdot N}{v} = (\Sigma \zeta_w \cdot F + \Sigma \xi_w \cdot J^{2/3}) \cdot \frac{\gamma}{g} \cdot v^2$$

in which π = efficiency of airship,
K = r.p.m. of engine,
N = HP of engine.

The front surface F of ordinary radiators on different aircraft, provided with like engines of 245 HP, was

For aeroplane with $v = 50.0$ m/s, $F = 0.203 m^2$.
" airship " $v = 29.3$ " $F = 0.600 m^2$ without air scoop.
" " " $v = 34.6$ " $F = 0.600 m^2$ with air scoop.

For the front surface of radiators

$\zeta_w = 0.53$ for 50 m/s.
$\zeta_w = 0.50$ for 35 "
$\zeta_w = 0.495$ for 30 "

A favorable speed for the radiator efficiency is generated in the radiator by the air scoop. Experiments with radiator air scoops in the bow of the engine nacelle demonstrated that the radiator drag was diminished 57%.

In order, with an airship engine, to remove 24.5% of the total amount of heat by means of the radiator, the latter's share of the total drag area at 34.6 m/s flight speed with radiator air scoops was

$$\Sigma \zeta_{wK} \cdot F_K = 0.43 \cdot 0.50 \cdot 5 \cdot 0.60 = 0.646 \ m^2$$

For cooling the exhaust gases, a further 36.5% of the heat had to be removed by the radiator.

We have no experimental values for gas coolers with air scoops.

We assume in advance (in order not to make too favorable calculations) that the front surface of the radiator had to be exposed to the full flight speed and we obtained for the radiator, as its part of the drag area

$$\Sigma \zeta_{wK} \cdot F_K = 0.50 \cdot 5 \cdot 0.60 \cdot \frac{0.365}{0.245} = 2.235 \ m^2.$$

The flight speed v with ordinary coolers or radiators is

$$(\Sigma \zeta_w \cdot F + \Sigma \xi_w \cdot J^{2/3}) = 12.75 m^2.$$

$$v^3 = \frac{75 \cdot 0.72 \cdot 5 \cdot 245}{12.75 \cdot 0.125} = 4140$$

$$v = 34.6 \text{ m/s.}$$

For airships with gas coolers the speed v g was:

$$v\,g^3 = \frac{75 \cdot 0.71 \cdot 5 \cdot 245}{(12.75 + 2.235) \cdot 0.125} = 3480$$

$v\,g = 32.65$ m/s instead of
$v = 34.6$ m/s without exhaust gas cooler.

By installing a gas cooler, the ship's speed was accordingly reduced 2 m/s, an amount which could probably be reduced to 1.4 m/s by using air scoops. Air scoops naturally add weight, but have the great advantage, in temperature and speed variations, of keeping the drag at a minimum on account of their streamlined shape.

4. Practical Experiments Have Thus Far Given the Following Results

(a) A gas cooler without air scoop, with about 2 sq. m. front surface, was installed on an airship with a speed of 20 m/s, and delivered about 100% of the weight of the gasoline consumed.

The efficiency was very good, but the thin channels soon rusted and could not be cleaned during the trip.

(b) In order to lessen the air resistance, the cooler (or radiator) was installed in the nacelle as a "rotor" and was expected to draw its own cooling air. It was thought to save energy by driving the rotor direct from the engine.

After several unsuccessful attempts, one experiment produced about 6% of the weight of gasoline consumed, in the form of water. This rotary exhaust cooler with 20 h.p. drive was too small. The channels, which were considerably larger than the ones in the stationary gas cooler, became clogged with rust after a few hours' use. It was difficult to collect the emerging water as it was immediately evaporated by the draft from the rotor. A larger plant would occupy too much room in the nacelle.

(c) Experiments in condensing the water vapor in the exhaust gases by means of a spray of water are being tried and have given 60% of the fuel weight, as the gain in water.

Methods a and c are the most promising. With a maximum energy outlay of 20% of the total engine power, an efficient water ballast winner can be operated.

The attempts to obtain the CO_2 in the form of ballast, by spraying milk of lime into the exhaust pipes, or absorbing the CO_2 with charcoal or coke, failed on account of the impossibility of chemical regenerations during the voyage.

(To be continued)

[8] In Automotive Industries, Vol. 15, p. 479, aeroplane radiator experiments are described, inaugurated at the Bureau of Standards in Washington, D. C., by the National Advisory Committee for Aeronautics, in which their head resistance or drag, their resistance to the passage of the air current and their weight with relation to the cooling effect was determined. The ratio of *heat energy lost* to *horsepower expended* varied for flight speeds of
29.6 m/s from 17 to 27.5,
34.0 " " 13 " 22.5
according to the kind of radiator.

Commercial Aviation in Montana

Putting commercial aviation in Montana on a successful business basis was worked out during the past year by the Aero Miles City Club of Miles City, which proved to the skeptical public that such an undertaking can be carried on with profit in this part of the country. The Club's operations were carried on by pilots A. W. Stephenson and E. T. Vance, both of whom were officers in the U. S. Air Service during the war. These pilots flew two Curtiss Standards and a Curtiss JN4, and deserve much credit for making the season successful. The Club derived its revenues from a large number of splendid exhibitions at the Montana State Fair and similar fairs in Montana and Wyoming, and from passenger business and instruction school.

The Aero Miles City Club is the pioneer in the field in the State and is doing all that is possible to promote the right kind of commercial aviation. Miles City has a good landing field and an effort is being made to have every town in Montana work out a field which can be used regularly.

A University Course in Meteorology

For the past three years a course in weather science applied to aeronautics has been given in the University of California at the Southern Branch located in Los Angeles. The present year at the University started Sept. 13 with a large enrollment of freshmen and sophmores and bids fair to eclipse the preceding years in interest and accomplishment. The majority of the members of the class are students in the engineering department of the University. Sixty-nine members are taking the course in aeronautic meteorology.

The object of the course is to make the students thoroughly conversant with the principles and practical application of meteorlogy applied to aeronautics.

Spokane News

Spokane—Renewal of the lease of the Parkwater aviation field is asked of the Spokane park board by C. H. Messer, president of the United States Aircraft corporation, which has had control of the field two years.

Mr. Messer told the board that his company had constructed a hangar at a cost of $3500 and had spent nearly $500 in clearing the land and had installed an oil and gas station where visiting flyers could get service. In the past 2 per cent of the gross receipts of the field has gone to the city.

Mr. Messer proposes that charges for services at the field and receipts from the field, with the exception of money actually taken in by the company itself, be turned over to the city.

Messer plans to throw the field open to all flyers with the stipulation that local commercial flyers should pay the city a proportion of their earnings.

NAVAL and MILITARY AERONAUTICS

Engines on the Airship Roma to Be Changed

Work has been started with a view to replacing the Italian Ansaldo motors on the Airship ROMA with the American Liberty engines. The Ansaldo is an excellent engine, but due to the lack of trained mechanics who understand this engine, a great deal of difficulty has been experienced in operating same. This has accounted for the delay in the Christening ceremonies, scheduled to be held at Bolling Field on Saturday, December 17th, but which did not take place until December 21st. On that day the airship flew to Bolling Field from Langley Field, after bucking a strong head wind for 5½ hours. Miss Fenrose Wainwright, daughter of Assistant Secretary of War Wainwright, broke a bottle of liquid air on the bow of the semi-rigid airship, following which the official transfer of the airship to the United States, for which Italy was paid $185,000, was made by Ambassador Ricci to the Secretary of War in a speech extolling Italian-American friendship. Then followed the presentation of the new battle pennant to the Assistant Secretary of War by Lieut.-General Vaccari of the Italian Army, and an inspection of the ship, General Patrick, Chief of Air Service, conducting the officials and other invited guests abroad for a view of the spacious operating room, with its two helms, one on either side, its window-lined cabin and the long passage way provided in the keel of the ship.

The sight-seeing trip over Washington and to Baltimore, which was originally planned, was called off by General Patrick after a consultation with the commander of the ROMA and the officials of the Weather Bureau, in view of a threatened increase in the wind and general rough weather for aerial cruising, also engine trouble.

Leaving Langley Field at 6:30 a. m., Major J. G. Thornell, commander of the ROMA, made the trip up most of the way on three engines against a strong northwest wind. He flew low and had some difficulty in negotiating the hills surrounding Bolling Field after he turned to the west in preparation to land.

The Secretaries of War and of the Navy, with Ambassador Ricci of the Italian Embassy, awaited with a big crowd of Army and Navy officers and guests for nearly three hours in the cold and wintry blasts which swept over the field. The monotony of the long wait was broken at frequent intervals when the Army Band, which played in an American and Italian flag decked stand, rendered various selections, and Lieut. Wolfe gave the crowd some thrills in his display of acrobatics in an SE5.

When the airship was moored on the ground, the squalls were so strong that a kite balloon had to be deflated so as to avoid its destruction.

The ROMA itself functions excellently, as this flight to Washington amply demonstrated, the ship arriving with only four of the six motors functioning, and one of these four running very poorly. The radiation surface of the Ansaldo engine is very large, due no doubt to the fact that the climate in Southern Italy, where the ROMA was originally flown, is much warmer than that around Langley Field and Washington, and on the trial flights of the ROMA, as well as on the official flight to Washington, these motors had a tendency to 'freeze." Considerable difficulty was also encountered because of the fact that they ran very oily. The principal reason, however, leading to the decision to supplant the Ansaldo with the Liberty is that it is contemplated in the near future to have the ROMA make a number of long distance flights to Scott Field, San Antonio, Texas. It is anticipated that eventually these flights will be extended to the Pacific Coast, as soon as hangar facilities are made available in that locality.

The hangar at Brooks Field is nearly completed, and concrete foundations are already set for the large hangar at Scott Field. On these long flights the motors will be running continuously from 24 to 48 hours and it will, of course, be necessary that they be completely overhauled at each of the operating stations, making it essential to have replacement engines at these stations in order that engines may be removed from the outriggers and replaced with new or overhauled ones. This procedure will only be possible with complete replacements at the various stations of Liberty engines, as the ROMA has only two spare Ansaldo engines. Then, again, the Air Service mechanics all understand the Liberty engine; spare parts are available at every Air Service station in the country; and it is anticipated that when the Liberty engines are installed there will be no more engine trouble on the dirigible.

It is expected that the maximum air speed of the ROMA with the new Liberty engines will be nearly 75 miles an hour, which will, of course, enable her to fight any wind that she may encounter and arrive at her destination without mishap.

Since the ROMA has beeen assembled in this country, a completely equipped radio room has been installed therein. During its entire flight from Langley to Washington and return she was in communication with both Bolling Field and her home station. There is also being installed a completely equipped photographic room, in which vertical photographs may be developed and printed within 30 minutes and delivered by parachute to any station over which she flies. With her photographic equipment, the ROMA will also be able to take excellent airscapes much more satisfactorily than they can at present be taken from aeroplanes.

The ROMA will be used as an instruction ship for the Airship School at Langley Field, where students who have graduated in one-man and two-man control airships will be given advanced instruction.

The Army Air Service is greatly pleased with the performance of the ROMA and feels that great strides in the development of our lighter-than-air program will be possible due to the experience gained in the operation of this ship.

Major Lackland's New Assignment

Major Frank D. Lackland, Air Service, recent graduate of the Engineering School at McCook Field, Dayton, Ohio, has taken up his new duties as Air Officer, Eighth Corps Area, relieving Major Carl Spatz, who has taken command of Ellington Field and of the First Pursuit Group. Major Lackland is amidst familiar surroundings, as his primary training was received at Kelly Field.

Art Smith an Instructor at Carlstrom Field

Carlstrom Field now has in point of experience one of the oldest civilian flyers in the United States. Mr. Art Smith recently arrived at the field, flying there from McCook Field. The trip was made in nine days—sixteen hours flying time—covering 1180 miles. Mr. Smith will instruct a class of five student officers in the class beginning January 1st, using his specially equipped dual-controlled JN4H Curtiss. His students will be checked at five hour periods and their progress noted. The Flying Department will keep a record of their progress to determine the merits of Mr. Smith's system over the Gosport system used at the field.

Reserve Aero Squadron at San Jose

The reserve squadron now being organized at San Jose, California, is entering upon an active recruiting campaign, as a result of which they expect to get considerable material of a high standard. Crissy Field is aiding in this campaign, having sent to San Jose its mobile machine shop, and Photo Section No. 15 mobile photographic truck and trailer. Major George H. Brett, Commanding Officer of Crissy Field, accompanied by Mr. Spiegel, a former Captain in the Air Service, 1st Lieut. F. D. Hackett and 1st Lt. R. S. Selff made a trip to San Jose in furtherance of the organization of this squadron, Major Brett gave an impromptu talk on Reserve Squadrons as well as the value of same to the community in which they are located. A very enjoyable get-together dinner was served, and during the course of the evening plans were devised for the future of the organization. Hope is entertained that San Jose will be able to furnish a suitable flying field so that the progress of this organization will not be retarded.

Fokker Achievement

According to London newspapers, Fokker, the famous Dutch aeroplane designer, who gave his name to the German fighting aeroplanes, has now invented and built a motorless aeroplane which can be towed behind an air express and "slipped" when over an intermediate air station. A pilot sits in the "aerial trailer," and after it is "slipped" by the engined air express, will guide it down to land. Thus it will be possible, it is said, for an air express on a journey from London to Brussels to drop passengers at Ostend without landing there, as a railway express train drops "slip coaches."

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut Street
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
J. SIDNEY OWENS, *2d Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. BAMBERGER
CHARLES L. HOWER
GEORGE S. IRELAND
FRANK A. L. LEAHY
JOHN W. PRATT
D. J. SPENCE, JR.
A. STANLEY TRUSCOTT

A joint meeting of the Pennsylvania Section, Society of Automotive Engineers and the Aero Club of Pennsylvania, was held at the Engineers' Club, evening of December 22nd. The engineers and business men of Philadelphia and vicinity were afforded a rare opportunity to learn of the latest developments in commercial aerial navigation, both in this country and abroad.

The meeting was one of a series being held in various parts of the country by the Society of Automotive Engineers and other interested bodies with the object of bringing out the true facts and clearing away any misapprehensions and ungrounded fears which may exist in the public mind with regard to aerial navigation as a business proposition.

Three unusually good speakers had been secured for the meeting. Mr. E. H. Shaughnessy, the Second Assistant Postmaster-General, in charge of the Air Mail Service, brought out some new facts about the usefulness and the real place of this branch of the postal service. Mr. William B. Stout, a widely known aviation engineer and designer, presented a very comprehensive paper on the "Requirements of the Commercial Aeroplane," with some figures on operating costs which proved very interesting. Mr. Ralph H. Upson, a balloon and dirigible expert who has had a great deal of experience both in the United States and Europe, outlined recent European developments in commercial aerial navigation.

As an added atraction, the Navy Department's films, showing the bombing of the former German battleships off the Virginia Capes last summer, had been secured for the meeting. These films have never been exhibited to the general public, being loaned to a few engineering and technical societies, and it was, perhaps, the only opportunity Philadelphians had or will have to witness them.

An informal dinner was given at the Engineers' Club, just preceding the meeting, in honor of Mr. Shaughnessy and the other celebrated speakers. A large audience was in attendance. Mr. Stout's talk on some of the wonderful work being done at the engineering laboratory and the samples of duralumin which he exhibited were intensely interesting.

On January 6th the spectacular feat of linking the two cities—Philadelphia and Camden—by a ribbon carried by aeroplane was performed as part of the celebration of the beginning of work on the great bridge which in a few years will connect those cities.

Just before the firing of the salute by the flagship Olympia, a plane from the Philadelphia Navy Yard, the N. 9, in command of Lieutenant A. C. McFall, and carrying Lieutenant R. Emerson as passenger, flew over Camden and released a parachute with the Camden colors. A similar parachute with appropriate colors was dropped while the plane was over Philadelphia.

In their flight across the Deleware, Lieutenants McFall and Emerson let out a long ribbon streamer, with a wire center to prevent breakage, which had been made by the women workers of the Naval Aircraft Factory. When the two cities had been connected by the streamer the Olympia fired a salute. The ribbon was a marker where later the great steel cables of the largest suspension bridge in the world will tie the two cities together.

Flying far above the N. 9 in its flight up the river was Commander H. C. Richardson, of trans-Atlantic fame, in another one of the Navy planes. The feat of flying the wire center ribbon was regarded as extremely difficult and dangerous, and it was only after considerable practice that word was sent to the Bridge Commission that the feat could be done.

On the eighteenth anniversary of the first human flight greetings, in the name of the Aero Club, were sent to Mr. Orville Wright, who on December 17th, 1903, made the first flight ever accomplished in a heavier-than-air machine. A most courteous, personal letter of acknowledgment was re-

(*Concluded on page* 503)

FOREIGN NEWS

French Aeronautics

It is understood from correspondents that the French Government plans to spend about $25,000,000 on civilian and commercial aviation in 1922. Of this amount $6,000,000 will be used for subsidies to the various French lines operating in Europe and Africa. The rest will be devoted to providing airways, airdromes, sheds, lighthouses, radio and weather reports.

The activities of the French subsidized air transport lines embrace routes: from Paris to London, Brussels, Amsterdam, Prague and Warsaw; from Bordeaux to Marseilles and Genoa; from Bayonne to Santander; from Toulouse to Casablanca and Oran; from Bucharest to Constantinople; from Antibes to Tunis; from Algiers to Biskra; from Dakar to Kayes, and two other lines in French Guiana. This represents roughly 6,100 miles flown over by recognized and regular French air lines.

It is reported that French civilian aerial transport companies from Jan. 1, 1920 to Oct. 1, 1921, have flown 2,070,000 miles and carried 20,300 passengers, with only 3 serious accidents.

The Committee for Aeronautical Propaganda (France) has offered a prize of one million francs for the best airplane motor, combining qualities "indispensable in a commercial engine." Tests will begin June 1, 1923. The Aviation Commission and the French Aero Club will draw up rules for the competition which will be open to foreigners, who, if they are awarded the prize, must undertake to manufacture the motor in France.

Admiral Fournier has communicated to the French Academie des Sciences an account of successful tests of apparatus for the guidance of planes to their aerodromes by night or in fog carried out at Villacoublay by Lieutenant Loth of the French Navy.

After more than a year's work Lieutenant Loth, who worked out a system of guiding ships into port in the thickest fog by wireless a couple of years ago, has devised a similar apparatus for planes which adds less than 10 lbs. to the weight of the machine. On ground there is a guiding cable with an alternating current of 600 vibrations per second. In the machine there are three receiving devices. One of them records a deep and loud musical sound—which the pilot hears with the aid of ear-pieces fixed in his helmet—so long as the machine is flying parallel with the cable. The sound diminishes when the direction of the machine makes an angle with the cable and ceases altogether when the direction is at right angles to the cable. The second spiral records its loudest sound when the machine is flying at right angles to the cable and ceases to record when the plane is going parallel. The sound recorded by the third spiral varies according to the distance of the machine from the cable, but it stops dead the moment the machine crosses the cable. The sounds can be caught as high up as 10,000 ft. and for a mile and a half on either side of the cable.

The first experiments failed because the sounds were drowned by the noise of the motors, but ear-pieces fixed in the helmets have overcome this difficulty.

The Paris-Bucharest air line now in operation requires 14 hours between the two capitals, including stops at Strasburg, Prague, and Budapest. It requires 63½ hours by the fastest train.

German Aeronautics

Eight German civil air lines are operating a total of 103 planes.

The Minister of Transport has decreed the suspension of subsidies for the German air mail services during the winter, because "the machines and present ground organization do not meet the requirements for winter operation, and because of the impossibility of increasing the number of aircraft as long as their construction is prohibited by the Allied Council."

By consent of the Dutch Government, two aviation schools have been opened under the supervision of German flying officers, in the Dutch East Indies.

Aeronautics in Switzerland

It is reported that a plant for the construction of a two-seater all metal Dornier sport seaplane has been erected at Rorschach, Switzerland, by a Swiss by name, M. Eggensperger.

The Swiss Government intends to establish an air mail line this year connecting with all the international air routes.

The Spain-Argentine Service

A mission composed of three Spaniards and two Germans have been in Buenos Aires, Argentine, since September, negotiating with the Government over the proposed airship line between Spain and Argentina. Terminal facilities and a subsidy, or other financial support, are among the matters being negotiated.

Japan to Study Flying

An Aviation Technical Institute and Aviation Council have been appointed under the Minister of Education. The institute will be attached to the Tokio Imperial University. The Minister of Education will be the president of the Council which will have 20 professors. Its duty will be "to deliberate upon important matters concerning the basic theoretic principles of flying machines."



The Effects or High Altitudes

ON account of the low temperatures encountered at high altitudes, the normal radiator area necessary near the ground becomes too great. Radiators are therefore usually provided with adjustable blinds composed of a series of narrow shutters, by means of which the cooling area of radiators can be controlled.

There is also another very important reason for this device—in order that the machine can come down, the engine must be practically shut off and consequently little heat is supplied to the cooling water circulating through the radiator. At the low temperatures met with, were the greater portion of its area not screened, it would quickly become frozen and cause the engine to overheat when the power was again put on.

Man is affected by altitude in much the same manner as an engine. The human body depends for its energy on the consumption of oxygen. As the density decreases, so does the amount of oxygen drawn in at each breath. As the altitude increases the rate of respiration increases. This, of course, cannot go on indefinitely. At a height of 16,000 feet the normal body has become a very poor machine. It is capable of sitting still and controlling the aeroplane, but any action calling for the display of muscular activity proves very exhausting. The brain also is affected and becomes sluggish in action. The obvious method of sustaining the pilot at great height is to furnish him with an auxiliary supply of oxygen. This is supplied to him by a tank of compressed air through a regulating valve and a mask which he wears. The valve is so adjusted that it automatically supplies an amount of oxygen which increases as the surrounding pressure decreases. The height at which oxygen should be used varies with the individual; 16,000 to 17,000 feet is about normal.

The Effects of Cold

The only other discomfort experienced is due to the cold. In the winter, even at very moderate heights, frostbite is not uncommon. It is usually the face which is attacked, owing to exposure. In cold weather the face is not exposed more than can possibly be helped. When prolonged flights at considerable height are indulged in, a complete face-mask is worn. The skin is also protected somewhat by rubbing it thickly with grease.

General coldness can only be guarded against by the use of suitable clothing. Electrically heated clothing has been manufactured for use at very high altitudes, but this is seldom necessary. Aerial clothing generally must be designed to be both heat-retaining and wind proof. As combining these two qualities, leather is the most suitable material. The ideal is a close-fitting one-piece garment. It should have no loose parts to blow about and should allow the maximum freedom of movement. The outer layer should be durable and windproof and the inner layer or layers should consist of thick material designed solely to retain the heat of the body. The position of the pockets is a matter of some importance. The pilot's seat, although comfortable, allows little room for movement, therefore the pockets must be so arranged as to be readily accessible without moving from the normal sitting position.

Cold is usually felt most in the hands and in the feet. Experience has shown that the wearing of silk next to the skin is most conducive to the retention of heat in these parts. Wool should be worn over the silk and then the gauntlet or boot. Gauntlets having no separate fingers are most satisfactory. If separate figures are necessary for any reason, a type of gauntlet with a mitt which may be drawn over the fingers at will is most desirable. Boots should be lined with sheepskin throughout and should extend up to the knee.

Scale Models Built by Readers of Aerial Age

A six-foot Curtiss model has been completed by two aeronautic enthusiasts of Marion, Ill.—Messrs. Joe Porter and Ray Horn. The model is built up and covered after the manner of the real plane. Seats and controls are installed. Wheels are 4 inches in diameter. The model can be easily taken apart and packed when desired.

The general dimensions are as follows:

Span (upper wing)	6′ 0″
Span (lower wing)	5′ 9″
Chord (both wings)	10″
Gap (between wings)	11″
Stagger	3″
Overall length	4′ 7″
Overall height	20″

A Curtiss model has been built by another young man from the Middle West—Ray Watkins of N. Park St., Bellefontaine, Ohio. In this instance the design chosen to follow was of a more recent type of Curtiss—the JN4H, the original of which is equipped with a 150 h. p. Hispano engine. The photographs below show the excellent manner in which the model has been executed.

These are the measurements:

Upper wing span	31½″
Lower wing span	24½″
Chord of both wings	4⅛″
Gap between planes	3⅞″
Stagger	¾″
Overall length	21¼″
Dihedral	3°

Fuselage

The fuselage is made of balsa wood, ⅛ inch square. Cowls are of 34 gage aluminum, painted olive drab.

Cockpits and seats are padded with leather. Wind-shields, of celluloid, are fastened to the cowls by fine wire. The rear cockpit is fitted with an imitation instrument board and a control stick which operates the ailerons and elevators, as well as a rudder bar which is in connection with the rudder.

The dummy engine is of wood, painted. The radiator is also of wood, painted so that its front face has the appearance of the cores on a real radiator.

Wings

Balsa wood is used for the wing construction. Front and rear spars are of I section. Leading and trailing edges are of 1/16-inch wire. The top wing panels have 20 ribs and the lower wings 14. There are 32 snap-fasteners used in connection with the streamlined struts, wing skids and overhang or cabane struts.

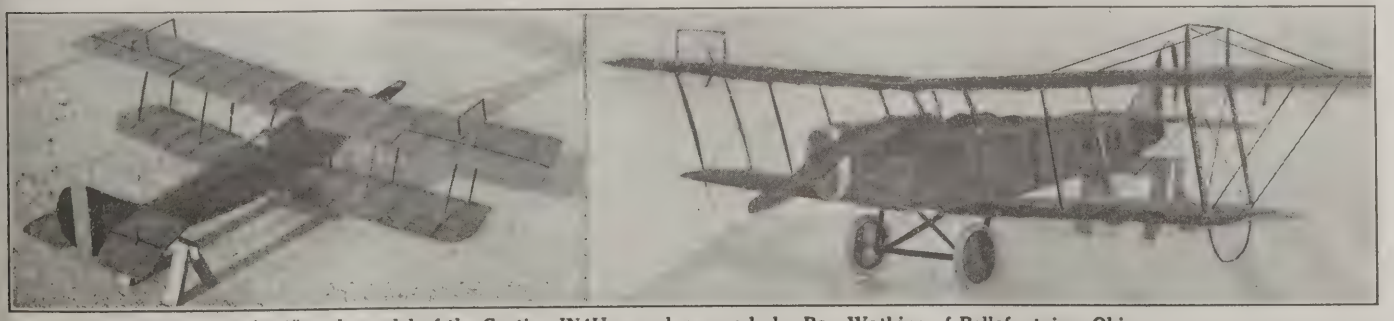
Ailerons are connected to the top plane by two aluminum hinges.

Tail

Five ribs, 1/16-inch thick, are used in the stabilizer. The elevators are fastened in the same manner as the ailerons.

General

Two 2-inch wheels are used on the landing gear. The propeller is carved from a 7-inch spruce block. Linen covering is used, coated, as in the large aeroplanes, with Valspar varnish.



A 31″ scale model of the Curtiss JN4H aeroplane, made by Ray Watkins of Bellefontaine, Ohio



The Last Flight

Where he got that wornout crate,
God only knows;
How he defied stern fate,
God only knows;
Where he got that winning smile,
That cherubic repose,
On a face so free of guile,
God only knows.

Tho his ship was a hopeless wreck
It didn't bother Jim,
And lacking of laws to protect
We could only jeer at him.
He spun and looped and rolled;
After all, his life was his own,
And the Lord protects the innocent
So he went to his death alone.

As he spun down a thousand feet
His ship half split asunder,
We who knew him best of all,
Came at last to wonder;
Did he go to his death with a smile?
Did he utter a single groan?
Did he ask "Is the game worth while?"
As he spun to his death alone.

For deep in our hearts we know.
'Twas all for love of the game;
And that, many of us will go
A-spinning down the same;
And many of us again,
On the trail with "Sunny Jim,"
Will jeer at his wornout plane,
On the "last flight," with him.

Lt. Art Peirce.

The Rookey

Lord Babbington was instructing the new colored servant in his duties, adding, "Now, Zeke, when I ring for you you must answer me by saying, 'My Lord, what will you have'?"

A few hours afterward, having occasion to summon the servant, his lordship was astonished with the following:

"My Gawd, what does you want now?"—Wayside Tales.

Gentle Hint

He: "I trust I am not tiring you with my presence?"
She (sweetly): "What presents?"

God made man
Frail as a bubble;
God made love,
Love made trouble;
God made the vine,
Was it a sin
That man made wine
To drown trouble in?

—Idaho Yarn.

MacNally: "I sent a dollar to the fellow who advertised to tell how to take out wrinkles in the face."

Fahey: "And did he tell you?"

Mac: "He did. He said walk out in the open air at least once a day, and the wrinkles would go out with me."

Do You Know That—

A red nose is no longer a sign of drink. He may have a girl who uses rouge.

The only thing harder than living within an income is living without one.

Discharging duty doesn't make much racket.

One should not coax a girl when she tells you that she can't sing, but should let it go at that.

Women who smoke didn't learn it from a kitchen stove.

Grass widows are not green.

A husband should never tell his wife that she will never be the cook his mother was unless he is hunting for trouble.

Some people think that the only way to preserve their youth is to keep it pickled in alcohol.

Clothes may make a man, but a suit of working clothes won't make a bum work.

One must sing a song of more than sixpence to get a pocket full of rye nowadays.

Some men lose their best friend by marrying her.

—P. H. A. C. Weekly.

The Blue Sky Trail

There's a golden trail to the setting sun, along the azure sky,
Where endless miles of fleecy clouds go gently sailing by,
While sunbeams paint in crimson hue, each grotesque shape and form,
And rainbows blend into the midst, false harbingers of storm.

There's a race of men who laughing go along the danger trail,
Who navigate the upper air, as the sea is done by sail.
Who battle its tumultuous storms and win through fog and snow,
Piloting their tiny craft where the trails of man may go.

When evening shadows overspread and the twinkling stars unveil,
A few of these will venture forth who love the Blue Sky Trail,
The Glory Trail that I shall travel, 'till the wings drop off the plane,
'Till the hinges creak and buckle, and I work the stick in vain.

When I drop in a yellow flare, a streak in the noon day sky,
Pray shed no tear in mourning, and heave no bitter sigh,
Just gather up whatever remains, ashes of limbs, or body or brains,
And take me aloft on the golden trail, where the God of sunset reigns.

When the clouds have a crimson hue and night is beginning to lower,
Drive me through the gateway, on the Blue Sky Trail, once more,
Then sprinkle me over the Western Front, the hallowed fields of fame,
Turn me loose, on the Blue Sky Trail, and tell them I "died game."

Lieut. Art. Peirce.

The Airplanes of Yesterday

We made 'em of tin, of pine and bamboo,
We tied 'em with string, we stuck 'em with glue,
We hammered 'em out in various ways,
We patched 'em together with strings and stays.

Where knowledge is guess work, guesses must serve,
And we knew that to fly, the wings must curve,
So we turned out the curves as we turned out the rest,
Products of chance, performance unguessed.

We made our designs with chart and stencil,
With foot rule, paper and bits of lead pencil;
We turned out the camber and angles at will,
And we knew that the factor of safety was nil.

But for all the defects of those wicked old hacks,
We flew and survived the inevitable cracks,
And those who performed on these ships of the past,
Have gone to their rest, all famous at last.

And for all the tacks, the strings and the glue,
They answered our purpose, the old crates flew,
They answered our purpose, and more can we say,
They made the game what it is to-day.

As we ride the new ships constructed to please,
And lounge in upholstery in safety and ease,
Let us pause for a moment and toast while we may,
Those flimsy, rickety crates, the ships of yesterday.

Lieut. Art. Peirce.

(*Concluded from page* 500)

ceived from Mr. Wright thanking the club for their letter and the greetings.

It is greatly to be regretted that throughout the United States it is doubtful if there is a single memorial to commemorate the deed accomplished by those two fearless pioneers of aviation: the Wright brothers. It has remained for those of foreign lands to honor them and recall their achievements.

At Le Mans, France, stands a beautiful sculpture, symbolic of human flight, erected to the memory of the Wrights and the demonstrations given of the aeroplane there in 1908 by Wilbur Wright. Each year the Royal Aero Club of Great Britain honors the memory of the brother who is gone by holding a memorial known as "The Wilbur Wright Memorial Lecture." This is one of the club's most important events.

At the January meeting of the club, which will be held at the Engineers' Club, Philadelphia, Jan. 21st, Mr. Steinmetz will appoint the following committees for the ensuing year. The first named member to act as chairman. House committee: Messrs. Bamberger, Spence and Truscott. Grounds committee: Messrs. Ireland, Hower, Kellett and Hall. Library committee: Messrs. Steinmetz, Gassner, Clarke, Leahy and Sheahan. Reception committee: Messrs. Steinmetz, Gassner and Huyette. Contest committee: Messrs. Hower, Ireland, Kellett, Leahy, Spence, Truscott and Miller. Program committee: Messrs. Steinmetz, Hower and Sheahan. Technical committee: Messrs. Clarke, Armstrong, Brownback, Philips, Bliss and Miller. Balloon committee: Messrs. Eldridge, Gassner and Wynne. Auditing committee: Bamberger and Spence. The following special committees will also be appointed with the first named member to act as chairman. Aviation meets: Messrs. Ireland, Hower, Kellett and Hall. Models and Boy Scout work: Messrs. Owens, Conrow and Pratt. Military aviation: Commander Richardson, Commander Westervelt and Captain Willoughby. Press: Messrs. Gassner, Bamberger, Steinmetz and Sheahan. Membership; Messrs. Spence, Ireland and Hower. Official Photographer, Sheahan. Flight Observers (appointed by the Aero Club of America). Messrs, Steinmetz, Sheahan and Wynne.

As this is to be a year of great activity by the Club, other committees and additional members will be appointed.

Congradulation and the pledged support of the Club have been sent to Hon. George Wharton Pepper, the newly appointed Senator from Pennsylvania. In the communication from the President of the Club, Mr. Steinmetz, he states: "In matters relating to air mails and aeronautic developments as well as the establishment of landing fields for the Great Centennial of 1926 you have the entire support of the Aero Club of Pennsylvania, who will be glad to work with you in any capacity you might suggest."

On Tuesday evening, February 21st, the members of the Club will have a joint meeting with the Engineers' Club, being invited to attend a lecture by Mr. Arthur Halsted, a pilot in the Army aeronautical forces during the Great War and now a member of the Department of Commerce Staff. Mr. Halsted will give a serious and interesting talk on matters connected with aviation and with special reference to accident features and their correction. The services of Mr. Halsted were secured through the courtesy of Mr. M. G. Lloyd, Secretary of Sectional Committee for Aeronautical Safety Code, Department of Commerce, Bureau of Standards, Washington, D. C.

W. H. Sheahan,
1st Vice-President.

(*Concluded from page* 494)

mined. Possibly claims on one accident are limited to the value of the machine to which it happened, as under Admiralty Law (which presumably already applies to seaplanes); possibly they are not. The operators of aircraft can only print a strong cover against liability on their tickets, or perhaps incorporate each plane as a separate company, and find comfort in the safety statistics. It is to be noted that the latter have already led the English insurance companies to strike the clause refusing flying risks from the ordinary life policies.

With the development of the air lines, the insurance rates will undoubtedly always serve as an excellent index on the effectiveness of whatever legislation or regulation there may be and of the soundness of air transportation as a public service and a business.

A Few General Conclusions

In reviewing the possibilities of an early and successful development of air lines in this country it is imperative that the European pioneering in this sort of traffic be closely watched and that the greatest possible use be made of the experience and statistics it has provided. Except as regards purely technical matters, however, these should be applied to American projects and prospects with great circumspection and the difference in political and economic conditions be kept clearly in view. The case of direct government subsidies is a striking one, these having been largely responsible for the development of traffic in Europe, while they are practically unthinkable in this country. What is wanted from the Government here is what may justifiably be looked upon as its natural obligations, that is, the provision of facilities of all kinds, as outlined above. That direct financial assistance ever fosters true progress and new developments no one believes. Human nature being as it is, the tendency is inevitable to regard official aid as manna from Heaven and let things take care of themselves; not to speak of the countless opportunities for favoritism, intrigue and worse, that it entails. Abroad, conditions are different in that respect. It should not be forgotten that most European trunk-lines are international in character and that national pride and political expediency are potent factors in matters of this kind. Also that the various governments have a much greater interest in the maintenance of a commercial air-fleet as well as a ground organization that can be requisitioned at short notice in case of need, than will ever be the case in this country.

Apart from their questionable desirability on the grounds touch upon above, direct subsidies should not be *necessary*. The variety of geographical and economic situations which the United States offers within its own boundaries will provide plenty of scope for financially successful commercial flying operations, if properly taken in hand with proper equipment. The moment that air transportation shows its inherent advantages to the business men of America they will use them on a scale which will leave European traffic figures far behind from the very start. The history of the automobile is a good example.

The amount of traffic, both in passengers and express matter from which the airplanes will be able to draw their share, is great. The "magnificent distances" to which President Harding alluded in his recent message on this subject automatically insure the saving in time that makes air travel pay.

But the first steps are always the hardest and official support in some practical form for operators and builders of commercial aircraft would do much to ease the situation. Contracts for the carriage of mail at rates, commensurate with the increased rapidity of delivery, could be given to reputable air transport concerns whose facilities for carrying out their engagements would bear investigation. Congress can make this possible as it did when mail coach and couriers were replaced by the railroad.

Another valuable form of subsidy would be the development of all purely war-types of machines in the shops of commercial builders and a system of awarding to designing firms paying production contracts for their own original products. Thereby would the aeronautical industry regain a good deal of the confidence which apparently it has lost. And the blending of the newest ideas in aeronautical warfare or defense with the most modern developments in efficiency and reliability would go a long way, in the writer's opinion, toward the reestablishment in this country of supremacy in the air.

Table 1—Official Statistics on the Airlines Between London and the Continent

From January 1, 1921 to October 30, 1921. Approximate total mileage flown, 700,000 miles. Not a single passenger killed or injured.

ROUTE	Distance in Miles	Number of Journeys	Passengers Carried	Journeys Carrying Mail	Journeys Carrying Freight	Journeys Completed to Schedule	Percentage of Journeys Completed	Type of Machines
								De Havilland
								Handley-Page
Paris-London	240	1141	4581	435	787	1021	90	Préguet
								Farman
London-Paris	240	1110	4521	317	407	1033	93	S. P. A. D.
								Vickers
London-Brussels[1]	210	260	298	148	153	243	93.5	Farman
								De Havilland
Brussels-London[1]	210	226	353	177	173	201	89	
London-Amsterdam[2]	265	176	200	160	166	167	95	Fokker F-3
Amsterdam-London[2]	265	175	275	164	147	162	93	
Total	...	3088	10228	1401	1830	2827	91.5	

[1] Service suspended owing to fire at Brussels aerodrome Sept. 28, 1921.
[2] Commenced operations April 14, 1921.

Baker's
A-A
Castor Oil



Specially Refined
for the Lubrication of
AERONAUTICAL MOTORS

BAKER CASTOR OIL COMPANY
Founded 1857
The Oldest and Largest Manufacturers of Castor Oil in the United States
120 BROADWAY NEW YORK

NOW AVAILABLE FOR YOUR AUTO
"The Plug That Cleans Itself"
Saves Gas **B-G** More Power
GUARANTEED CARBON AND OIL PROOF
Recognized as the best for aeroplanes, its success for automobiles is assured
B-G CORPORATION
33 Gold St., New York
If your dealer cannot supply you, send us his name and $1.00 for each plug, stating name and year of manufacture of your car.

MOTOR REBUILDING
CYLINDER GRINDING
ALUMINITE PISTONS
Iron Pistons, Piston Pins and Rings.
COMPLETE MOTORS
Parts for all airplanes and motors.
Finest equipment in U. S. for motor work.
GREEN ENGINEERING COMPANY
Dayton, Ohio
Main St., at Burns

TITANINE
TRADE MARK
DOPES AND COVERING MATERIALS
Can be obtained through

JOHNSON AIRPLANE & SUPPLY CO.		Dayton, O.
F. J. LOGAN	712 Superior W.	Cleveland, O.
N. STEELE		Denver, Colo.
F. C. AYARS	Box 294	Beaumont, Calif.
JAMES LEVY	2055 Indiana Ave.	Chicago, Ill.
DE LUXE AIR SERVICE		Asbury Park, N. J.

Made by
TITANINE, Inc., Union, Union County, N. J.

FLYING SCHOOL
Our Graduates Are Satisfied
YOU WILL BE TOO
If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.
Write for booklet
PHILADELPHIA AERO-SERVICE CORPORATION
636 Real Estate Trust Bldg. Philadelphia

Aerial Photographs
WE are always in the market for good aerial photographs, and we invite our readers to submit to us aerial views of landscapes, seascapes, forests, mining regions, etc. Address:
Photo Department
AERIAL AGE WEEKLY
280 Madison Avenue New York

L. P. WITHERUP
Mechanical Designing Engineer
Specialist on
Lubrication and Bearing Problems.
I Make Your Own Bearings or Bushings Work Without Heating.
DESIGNING, DEVELOPMENT, DETAILS, DELIVERY } of { Internal Combustion Engines of any type, class or service. Airplanes to Farm Engines. Invention Devices, Manufacturing, Air Compression, Pattern and Machine Work.
If you have a two-cycle engine giving you trouble or will not develop its full power, write me particulars and I will straighten it out.
LOCK BOX 1472, CINCINNATI, OHIO

WING COVERING
Accurately Done
Grade A Cotton 40c per yard.
Scalloped Cotton Tape 2¼" 4c per yard.
G. VOISIN, Expert
21 years of practical experience. Contractor to U. S. Air Mail
70-72 Rome St. NEWARK, N. J.
Tel. 9170 Market

AVIATION SCHOOL
courses in
FLYING, MOTOR BUILDING, RIGGING
You fly the day that you arrive
PLANES REBUILT MOTORS OVERHAULED
Write for prices
THE SANFORD AVIATION TRAINING CO.
Brunswick, Ohio

UNIVERSITY OF ILLINOIS LIBRARY
7 1922

AERIAL AGE WEEKLY

VOL. 14. No. 22 FEBRUARY 6, 1922 10 CENTS A COPY



Airscape of the Naval Air Station, Washington, D. C. Photographed by the U. S. Air Service

Common Sense in High Places—The Huff-Daland Thick Wing Biplanes—The French Air Routes

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
bscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

QUALITY
SNAP RINGS

More Than
a Million a Month



Falls
MOTORS
are *also* equipped with
Quality Snap Rings

THE Piston RING COMPANY
MUSKEGON, MICH.

February 6, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 22

TABLE OF CONTENTS

Common Sense in High Places.... 511
The French Air Routes..... 511
The News of the Week..... 512
The Aircraft Trade Review..... 513
The Huff-Daland Thick Wing Biplanes 514
A Preliminary Investigation of a New Method for Testing Aerofoils in Free Flight 516
Langley Field Wind Tunnel Apparatus 518
Traffic Airships with Special Reference to Economy 520
Elementary Aeronautics and Model Notes 523
Foreign News 524
Soaring Flight..... 525
Aeronitis 526

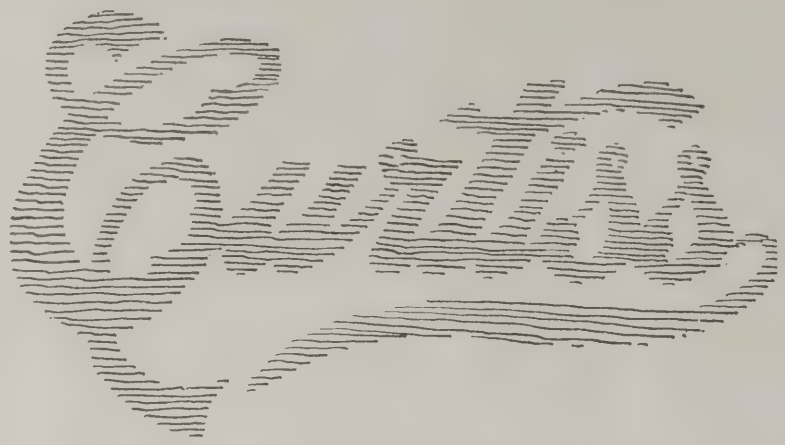
PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

DEALERS WANTED



Three 3 place Lincoln Standard tourabouts leaving our flying field December 21st, 1921, the plane to the left for Los Angeles and the other two for Oklahoma City. Reading from left to right: G. E. Bennett of Los Angeles, who just purchased plane to left; Ray Page, Gen. Mgr. Nebraska Aircraft Corporation; Jack Atkinson, Pilot, who will fly ship to the West Coast; L. L. Bell, Kansas City, who flew as passenger in center ship to Oklahoma City, where he will learn to fly his new Tourabout; I. O. Biffle, our Test Pilot and Chief Instructor; S. Long of Kansas City, who flew as passenger to Oklahoma City in ship to right, to take his flying instruction in his new Tourabout. Zero weather has no effect on the flying qualities of our planes.

NEBRASKA AIRCRAFT CORPORATION
Lincoln, Nebraska



Announcing 1922 Price List

NEW PRODUCTION

	LIST PRICE
ORIOLE:	
With OX5 Motor	**$3000.00** F.O.B. Buffalo, New York
With K-6 Motor (1919)	**4400.00** F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	**4800.00** F.O.B. Buffalo, New York
SEAGULL:	
1919 K-6 Motor, dual stick control	**5200.00** F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	**5600.00** F.O.B. Garden City, L. I.
STANDARD:	
With C-6 or K-6 Motor	**3600.00** F.O.B. Garden City, L. I.
MOTORS:	
C-6 or K-6 (150 H.P.)	**3000.00** F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

JN's:	
JN4D with new OX5 Motor	**$2400.00** F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	**$1200.00 to 2200.00** F.O.B. Dallas, Texas
STANDARDS:	
With new OX5 Motor	**2000.00** F.O.B. Houston, Texas
With overhauled OX5 Motor	**1700.00** F.O.B. Houston, Texas
Without motor, rebuilt for OX5	**1100.00** F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	**1600.00** F.O.B. Garden City, L. I.
Without motor, as received from Government	**800.00** F.O.B. Houston, Texas
MOTORS:	
OX5 New	**800.00** F.O.B. Various concentration fields
OX5 Overhauled	**600.00** F.O.B. Various concentration fields
OX5 As received from Government	**500.00** F.O.B. Various concentration fields

NOTE: Where delivery is made from other than F.O.B. points, accrued transportation charges must be added.

WRITE FOR DETAILS IF INTERESTED IN BECOMING A DISTRIBUTOR OR DEALER, STATING TERRITORY DESIRED.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., February 6, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, FEBRUARY 6, 1922 No. 22

Common Sense in High Places

NOTHING since the war has been more encouraging to aeronautics than the report of the sub-committee on aeronautics of the limitations of armament committee. The sub-committee in its report stated that "it is not practical to impose any effective limitation upon the numbers or characteristics of aircraft, either commercial or military, excepting in the single case of lighter-than-air craft." In essence, it is the dictum of the committee that every encouragement should be given aeronautical science which is still in its youth. "Any limitation as to the number and character of civil and commercial aircraft, heavier-than-air and lighter-than-air, which is efficacious to hinder their utility for war purposes, must interfere disastrously with the natural development of aeronautics for legitimate civil and commercial purposes," continues the report. "To limit the science of aeronautics in its present state is to shut the door on progress."

It is impossible to foresee the consequences to human progress from aeronautical development. They will certainly be marvelous where natural conditions are favorable to such development. To try to limit them now with arbitrary laws, even if these laws have the purpose of preventing war, would be, in the opinion of this committee, disastrous from the point of view of world progress.

The committee believes in the possibility of use in war of large dirigibles, but calls attention to the fact that dirigibles become increasingly efficient with increase of size, and that any limit imposed upon the size of commercial dirigibles must close the avenue of development for legitimate civil enterprises. This question, it is pointed out, should be left to the international air convention, or to a special convention to which the assent of all powers represented at the armament conference can be given.

The French Air Routes

SOME very interesting figures relating to the progress made by the French aerial routes have been issued by the French Under-Secretariat of State for Posts and Telegraphs. These figures disclose that, taking the twelve months from October, 1920, to October, 1921, the mail traffic on the London-Paris route has steadily diminished in volume. In October of last year 3,005 postal packets were carried, while in the corresponding month of 1921 this number had fallen to 1,923. It may be remarked that it is quite possible that a good deal of this decrease is due to the fact that regular British lines are running and are obtaining their share of the mail traffic. Nevertheless, the figures are somewhat curious, the more so as we find the same conditions affecting other French lines, which are not subject to outside competition. The Paris-Brussels service shows an astonishing falling-off, only 71 letters being carried last October, as against 621 in the corresponding month of 1920. Paris-Amsterdam shows a decrease from 176 in May last to 35 in October, while the figures of Paris-Strasburg fell from 115 letters in October, 1920, to 64 in October last.

On the other side of the picture, we find that Paris-Prague rose from 138 packets of mail in 1920 to 863 in October of this year. The Paris-Warsaw route, opened in May last, carried 344 letters in that month against 877 in October. A really wonderful result is shown by the route Toulouse-Casablanca. In October of last year this service carried, out and home, 24,349 postal packets, and in the corresponding month of 1921 this total had increased to 40,607. During the whole year no fewer than 306,181 letters were carried by this service, Paris-London coming next with 28,534.

The deduction to be drawn from these figures seems to be that the business community does not attach a great deal of importance to the saving of a few hours on the shorter aerial routes, but that where the saving of time amounts to days, as it does in the case of the Toulouse-Casablanca route (by which five days are saved in comparison with train and steamer), there is a rush to take advantage of the facilities afforded by the aerial mail. The figures are more than a little interesting, and can, we think, be studied with advantage by our own postal authorities, who seem dubious as to the advantage or otherwise of using aerial mail on long runs. The way they appeal to us is that they prove that the longer the distance over which aerial conveyance is used the more rapid the growth of the traffic and the more successful the enterprise must be.



THE NEWS OF THE WEEK



Commercial Air Conference at Sioux City, Iowa

Sioux City, Ia.—The aviation conference of the states comprising the 7th Corp Area will be assembled in Sioux City on March 27th, 28th and 29th, for the purpose of completing city and district organizations in the entire corp area. This district includes the states of North and South Dakota, Minnesota, Nebraska, Iowa, Kansas, Missouri, and Arkansas. Delegates from each city within these states will be in attendance as well as a large number of men nationally identified in aerial development, to take an active part in organization work.

The Seventh District Conference, the first of a series of similar meetings, is being sponsored by the National organization, of which the district organization will become a part. The conference is being called and will be conducted under the jurisdiction of John B. Coleman of Sioux City and Rufus Rand Jr., of Minneapolis, representing the national organization, and E. R. Schultz, Chairman of the Seventh Corp Area Convention. In addition to organization work, the program includes plans to make the central west lead America in commercial aviation development.

The larger towns and cities in the states of the seventh district will be the first to take an active part in the organization, as the advantages to be had from aerial mail and transport services has been demonstrated by the Government Air Mail service and all enterprising cities are displaying great interest in plans for the extension of this method of transportation. A strong and representative delegation of business interests from each city of five thousand population or over is invited to join in the concerted efforts to be launched at the Sioux City conference, to bring aerial mail and transportation to our respective cities.

The original tentative plans were for dates in January which have been changed to March in order to allow additional time for the formation of the organization of the national association in Washington.

American Bankers Fly to Havana from Key West in Seventy Minutes

Advices have been received by C. F. Redden, President of the Aeromarine Airways, Inc., from Havana, Cuba, that a party of important Wall Street financiers headed by Charles E. Mitchell, President of the National City Bank, Percy G. Rockefeller and E. P. Swenson, chairman of the Board of Directors, arrived at Key West recently in a private car en route for Havana.

Upon learning that the trip across the Gulf by steamer required approximately eight to ten hours, they chartered one of the Aeromarine Navy eleven-passenger air cruisers—the "Ponce de Leon"—and made the flight in seventy minutes, establishing a record for this voyage.

Others in the group were Guy Carr, Jos. P. Grace and Lee Olwell, associates of the Board. Other interests were represented by Gordon S. Rentschler and E. A. Deeds of Ohio.

Owing to the large amount of baggage, officials of the Aeromarine Airways, Inc., sent another eleven-passenger flying cruiser as a special luggage boat, hence the entire party and their baggage arrived in Havana before the steamer had left its dock at Key West, and thereby saved one day's valuable time.

Notwithstanding the fact that the latter part of the flight was made in a driving rainstorm, the entire group stated that they were delighted with the swift and fascinating flight across the Gulf, and as the boats have enclosed cabins and are as luxuriously appointed as the private car in which they arrived at Key West, they were entirely protected from the elements.

Colonel Hartney Improving

Colonel H. E. Hartney is improving at Walter Reed Hospital from the effects of the accident he sustained while competing at Omaha in the Pulitzer Race, last November. A recent set back gave his friends cause for uneasiness but did not remove from the Colonel's countenance one of the finest smiles known to man.

The Late Emory H. Rogers

Emory H. Rogers of Rogers Aircraft, Inc., Venice, Calif., was accidently killed recently. In his death, aviation suffers an irreparable loss. Few men in aviation have a clearer view than had Emory Rogers, whose faith in the future and determination to do all in his power to make his dreams come true were recognized as his chief characteristics. "Em," as he was affectionately known by those with whom he came in contact, had repeatedly said that he would rather lose money in aviation than make it in any other line of business, always contending that aviation was a business and not a "game," as by many it is still erroneously considered. Aviation, especially on the Pacific coast, will miss Rogers' smiling face, unbounding energy and ability to accomplish what he started out to do. It is gratifying to know that his associates are more than ever determined now to carry on his work in aviation thereby building a monument to him in recognition of their deep regard for the ability of Emory H. Rogers as pilot and friend.

McConnell With the Literary Digest

Burt M. McConnell, who wrote "The Aviator's Sixth Sense" for the *Saturday Evening Post* in the summer of 1917, is now one of the editors of the *Literary Digest*. McConnell was stationed at Essington in 1917, at Gerstner Field during the winter of 1917-1918, and went overseas in the summer of 1918. He was at Souilly when the Armistice was signed, and returned home in July, 1919, after touring the A. E. F. on the "Press Special." McConnell was married on January 1, 1920, to Miss Gertrude M. Allen, of Providence, R. I., who had been Vilhjalmur Stefansson's secretary when McConnell was a member of his last Arctic expedition.

The Airways Association

The Airways Association, comprising the students taking the course in airplane mechanics at the American Airways training school at College Point, New York City, has just become affiliated with the Aero Club of America.

The association, which was organized in September 1921, has made rapid strides, both in membership and in their activities. The chief purpose of the association has been student government, acting through their chairman in approaching the faculty of the school, and it has been found, in practice, to be mutually advantageous, and has been encouraged by the school.

The purpose of the body is to encourage and further the cause of aeronautics in general and the interests of the men connected with it, besides its social side. Membership is extended to anyone interested in the development of aviation and flying in general.

The recent elections selected the following officers: President, J. J. Higgins; Vice President, R. W. Jackson; Secretary, John Higgins; Treasurer, E. E. Seeley.

CALENDAR OF COMING EVENTS

under sanction of

AERO CLUB OF AMERICA

April 30th (1 or 2 days)

Spring Show and Opening Meet

Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for

Detroit Aerial Water Derby

Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy

Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet

Pulitzer Trophy
Detroit Aerial Derby

for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races

Detroit News Aerial Mail Trophy

for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)

In Preparation by the Aero Club of America

American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th

First Annual Interservice Championship Meet

Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)

Foreign Events

Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)

Coupe Henry Deutsche De La Meurthe
Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

The Durant Airport

On January 1st the Clarke Aerial Service Company, a concern operating in the bay region for the past two years, leased Durant Field and has opened same as an active aerial terminal to be known as Durant Airport.

It is planned to make this airport the northern home of a Los Angeles-Oakland aerial line and to conduct it for the general betterment of aeronautics. The field is 2,200x1,450 feet, centrally located, has storage for at least nine ships and offers gas, oil, water, telephone service, etc. Besides this there will be a school and shops are being erected at the present time.

Farman to Try for World Endurance Record

W. Wallace Kellett, the Farman representative in America, has received a cablegram from the factory in France, stating that a Farman Goliath will attempt to beat the world's endurance record early in March. The machine will carry approximately three tons of fuel, food for two days, and is expected to remain in the air at least 40 hours. There will be two pilots, as yet not chosen.

A Farman Goliath held the world's record from June, 1920, till December 29, 1921, when Eddie Stinson and Lloyd Bertaud kept a J. L. 6 All-Metal Monoplane in the air over Roosevelt Field, Long Island more than 26 hours and 19 minutes, beating the Goliath's record by 2 hours 33 seconds.

Mr. Kellett, whose offices are in the Widener Building, Philadelphia, has requested further details concerning preparations for the new test of the Goliath.

Florida Seaplane Stations

In addition to the seaplane stations referred to in a recent issue of AERIAL AGE, in Florida there are excellent facilities for seaplane landings at Palm Beach and West Palm Beach. West Palm Beach has an excellent bottom for anchoring anywhere in the lake along the water front and wherever there are no seawalls the ships can be beached along the lake shore. The American Trans-Oceanic Co. have hangars here with various supplies and the Power Marine Ways Co. are able to furnish gas, oil and fresh water from the head of their wharf, which is approachable from any direction.

The lake on which the towns are located is fine for landing and taking off, being twenty-two miles long and three-quarters to one mile wide. There is also a cut from lake to ocean which can be used for the towing of crippled ships from the ocean to the lake.

Airplane Carriers

Washington—The sixth draft of the five-power naval treaty contains a substantial change in connection with aeroplane carriers. While the original provision limited the tonnage of aeroplane carriers to 27,000 tons, the treaty now authorizes the powers to keep the hulls of two capital ships and convert them into carriers, not to exceed 33,000 tons, with a provision that hulls so converted shall be rendered wholly unfit for use again as capital ships.

This change will enable the United States to convert two battle cruiser hulls, and Japan two superdreadnaught hulls. The change was urged by American and Japanese technical experts and naval officials as a measure of economy in connection with the scrapping of ships.

It is estimated that Japan can keep her two converted battleship hulls within 27,000 tons, which remains the authorized size of aeroplane carriers as a general proposition, but that it will not be possible to convert two American battle cruisers in such a way as to get their displacement much below 33,000 tons.

In order to compensate the other powers, provision is made that they may build not exceeding two aeroplane carriers of 33,000 tons. Any additional carriers must be kept within the 27,000-ton limit.

Air Service Bids

Sale—Air Service, U. S. Army Engineer Division, McCook Field, Dayton, Ohio.—Bids are wanted until February 9 for the purchase of a quantity of waste material, including 303 pounds aluminum sheet, 1,114 pounds aluminum castings, 835 pounds brass, 720 pounds copper, 285 airplane radiators, 5,900 pounds steel, 3,563 pounds scrap iron, about 600 pounds rubber, 110 assorted propellers, 14,000 pounds baled paper, 23 propellers and 59 barrels.

Indicators—Office of Chief of Air Service, War Department, Washington.—Bids are wanted until 2.30 p. m. February 16 for furnishing 50 turn indicators and venturi tubes. The date of opening for these bids was originally set for January 27.

Balloon Cloth—Office of Chief of Air Service, War Department, Washington.—Bids are wanted until February 6 proposal 32, for furnishing 8,000 yards A A balloon cloth and 40,000 yards B B balloon cloth.

Sheet Steel—Office of Chief of Air Service, War Department, Washington.—Bids are wanted until 2.30 p. m. February 14, circular ASA33, for furnishing 5,219 pounds sheet steel.

Internal Bomb Racks—Office of the Chief of Air Service, U. S. Army, Washington.—Bids are wanted until 3 p. m. February 14, circular 37, for furnishing 50 internal bomb racks, f. o. b. Fairfield, Ohio, and f. o. b. factory.

Ferro-Silicon — Air Service, U. S. Army, War Department, Washington.—Bids are wanted until February 11 at 2.30 p. m., circular ASA 34, for furnishing 355,000 pounds ferro-silicon.

New Air Mail Ship—Type DHM-2

The editors have received the following interesting statement from the Wittemann Aircraft Corporation.

"The U. S. Air Mail Service, under the guidance of able and progressive men has developed from a plaything to an organization which is carrying the mail almost as cheaply as the railroads and excelling them in speed and efficiency at every turn. At the close of the War, there was a tremendous amount of new aviation equipment and machines on hand, and this was made available for postal service. Although none of the machines available was ideal for the Air Mail Service, the De-Haviland-4, a two place day bomber and fighting machine, was considered the best.

"As the Air Mail was still in its experimental stage, the price of new machines was prohibitive, therefore, the De-Haviland-4's were remodelled slightly; that is, the Pilot's seat was moved aft and the bomber's gun ring removed and the forward cockpit, which was the original pilot's seat, was changed into a mail compartment.

"These machines were successful as they were fast and reliable, but there was one great drawback, *i. e.*, their inability to handle more than four hundred pounds of mail satisfactorily. The men in charge of the Air Mail continually tried to improve this and some of these machines were turned into twin motor ships, in others the wing area was increased, but in every case a logy unsatisfactory ship was produced.

"Last summer the Wittemann Aircraft Corporation entered into an agreement with the postal authorities to remodel one of these ships along new lines and double its carrying capacity without altering its speed, with the result that the Ship No. 250, known as the DHM-2 Type, was produced which has exceeded in performance even the claims made for it by its designer.

"There were many minor refinements made in this new design, but the main ones were, first, the motor bed was raised four inches. This brought the line of thrust of the motor more directly down the center line of the fuselage. Secondly, the cowling of the fuselage was remodelled permitting a larger mail compartment, and also improving the general streamlining of the fuselage as a whole. Thirdly, the span was increased by six feet on both the upper and lower wings, this was done by adding stub planes on each side of the fuselage and building a new and larger center section, and in doing this, wires were replaced by struts and the head resistance considerably decreased. There were many other changes made, but these were the most radical.

"Without any special adjustments to the motor or fairing of the wires, and with a load of 850 pounds of mail, this ship attained a speed of 122 miles an hour and a climb of 900 feet a minute at the ground with an absolute ceiling of 17,300 feet and a service ceiling of 15,000 feet. The distance of take off of this ship with the 850 pounds of load, compared with a regular DeHaviland-4 with a 400-pound load, proved to be practically the same, and the gasoline consumption at cruising speeds showed a saving of as high as three gallons an hour. On a special test flight, this ship carried a sand load of 1,100 pounds and handled perfectly.

THE HUFF-DALAND THICK WING BIPLANES



The HD-9A with 10 cylinder Anzani engine

HUFF, Daland & Company of Ogdensburg, New York, have recently produced two extremely interesting developments of thick section Cantilever construction which are worthy of close consideration.

The HD-9A was brought out to meet the Army requirements of a Type-14 air-cooled engine training plane, and was recently flown by Lieut. Harris at McCook Field.

The "Petrel" HD-8A is a further development of this machine, incorporating the OX-5 motor as a power plant, and some changes in the lines of the fuselage, permitting a more perfectly streamlined body. This machine has been produced to meet the growing demand for a sturdy, moderate powered three-place aeroplane of simple construction, capable of being operated and maintained at the lowest possible figure. This identical machine, moreover, has been accepted by the U. S. Army arranged as a dual control two seater for training purposes.

Both machines present a novelty in small craft construction, with a side door of ample dimensions, extending to the very bottom of the fuselage, affording a great convenience to passengers—a feature which is allowed in this type of construction without cutting any of the working members.

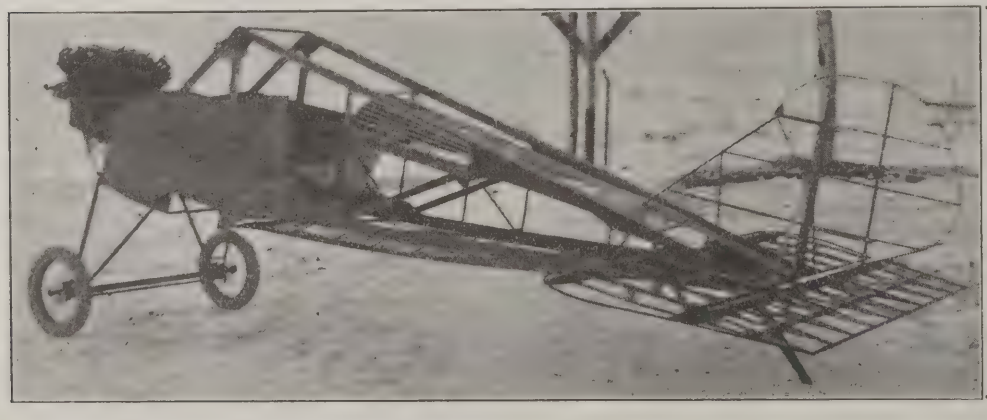
Inasmuch as the two models follow the same general type of construction except for motor installation, their general specifications will be given together.

Fuselage: The fuselage follows closely in design to the HD-4 training plane, which was successfully sand loaded, flight tested, and accepted, by the Army during the past year at McCook Field. Rigid longerons carry the loads from tail to wings by direct wooden paths, while veneer and linen sides, and suitable struts complete the structure without the use of any wires in the vertical plane. The cockpit in both machines is of extremely roomy proportions without any divisions whatever, allowing ready entrance and exit through the door, and convenient contact between pilot and pupil or passengers as the case might be. This feature has proven of great importance in instructional and passenger carrying work where the psychological effect and the opportunity for the closest co-ordination with the pilot is an important feature.

Wings: The wing section employed in both machines is the Göttingen 387, the first machine in this country, so far as is known, to be built with this extremely efficient thick wing design. Both, upper and lower wings, are built upon veneer sided box spars of conventional type. An interesting feature, however, is the termination of this veneer at points about one-fifth of the span from either tip; a built up Warren Truss supporting the upper and lower beam members from this point to the tips. The ribs are of special construction and novel design. Due to the great depth, two independent girders of basswood are used to form the top and bottom flangs, fastened together by suitably spaced vertical members, while the cloth is sewed separately about the upper and lower parts, giving added security by forming an independent attachment for both surfaces. Sand tests have carried these ribs beyond the required factor of eight without sing of faiure. The entering edge is of veneer, while the trailing edge is wood. An interesting feature is the double set of drift wires, which independently truss the upper and lower members of the spars preventing any possibility of rolling and giving unusual rigidity. As will be seen from the photographs, the upper wing is very simply supported with a rigid connection between the rear beam and the apex of the fuselage lengerons and three additional struts on either side; the arrangement of all struts being similar to the Fokker D-7 with spans and chords approximately the same. These struts, as well as the N struts at the tips, are of streamline steel tubing, the latter adjustable for the correction of incidence. The lower wing is raised into a recess in the bottom of the fuselage, and is held in place by four large bolts.

Ailerons: The ailerons are balanced and of the washed-out type, giving an unusually light and sensitive action to the controls, as the very smallest motion in either direction gives an immediate bite on the air. Ailerons are carried upon false spars in the upper wing only, the area and arrangement being identical with Fokker D-7 design. The construction is extremely simple, consisting of a large front tube and a small tube at the trailing edge connected with short triangular ribs of steel tubing. The horn is welded directly to the main tube and supported by a rib flange part way up its length.

Controls: Controls of the ailerons is obtained through a push and pull rod extended within the length of the wing, connected by a bell crank and tube to the horn. Movement of this push and pull rod is obtained by the use of two wires running over four pulleys, and fastened to it directly above the cockpit. It will be seen from this, that by removing these two connections, readily accessible through hand holes in the lower surface, the upper wing and its controls may be removed and handled as a unit, while the necessity of inspecting pulleys inconveniently located in the upper wing is entirely eliminated. Tail surface controls are conventional, with wires carried inside the fuselage. One-eighth inch stranded cable is used throughout. The torque tube, stick, and rudder bar are mounted as a unit in the cockpit; two separate horns welded



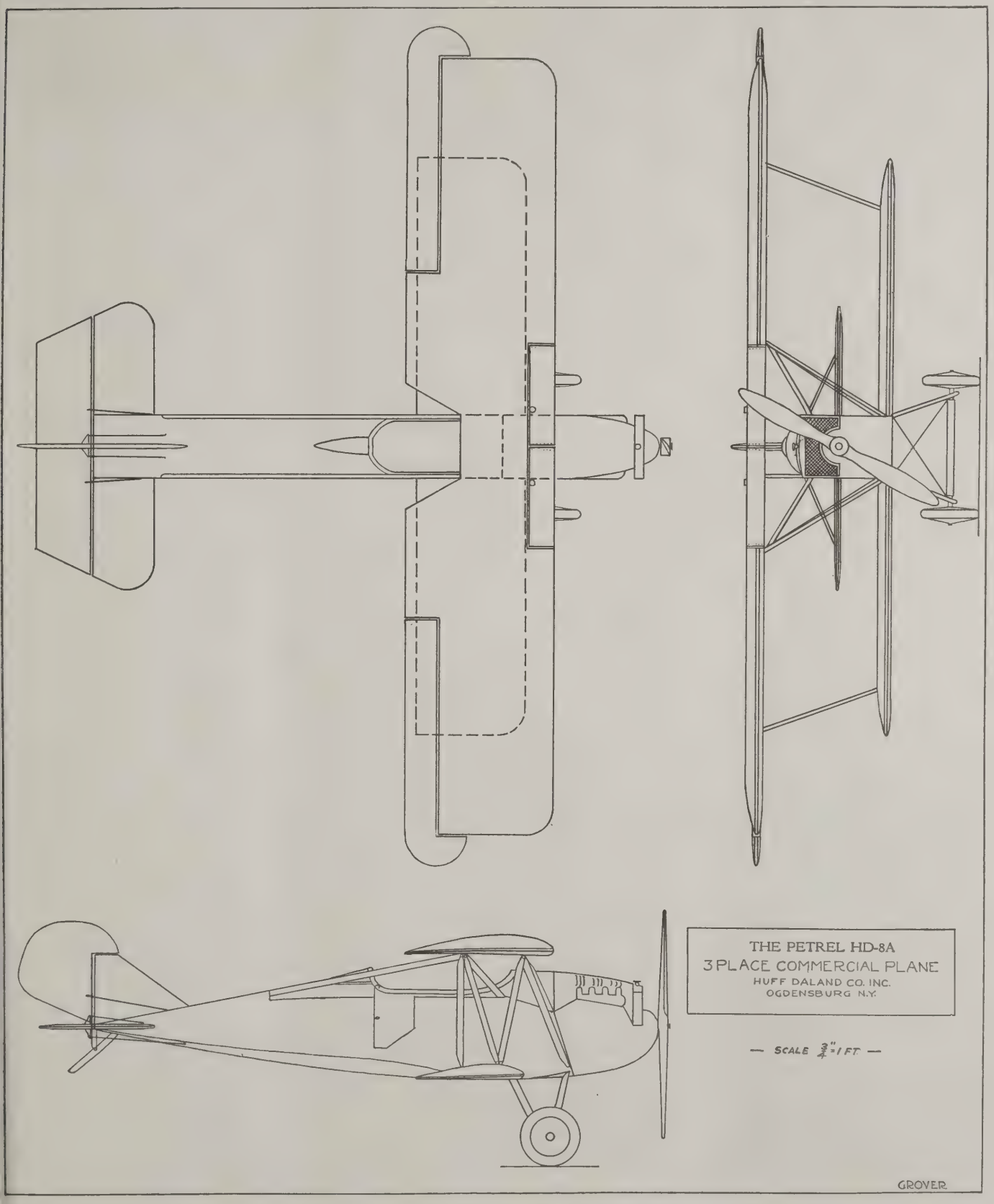
Showing the fuselage construction of the Huff-Daland "Petrel" with Curtiss OX5 engine

directly to the torque tube carrying the aileron control wires to the upper wing.

Tail Surfaces: The tail surfaces on both machines follow closely the type developed and successfully demonstrated on the HD-4. The elevator is continuous and fastened to the stabilizer at four points. The stabilizer is adjustable, and almuinum sheathing is provided for its union with the elevator to prevent leakage and insure smooth air flow in all positions. The fin and rudded are rigidly supported by two adjustable struts connecting to stabilizer and fuselage on either side, no wires being employed.

Gasoline System: The gasoline system is novel, extremely simple, and has proven effective under the most exacting conditions. It is an important feature of the machine and is a decided advance in this vital point of design. Two 11-gallon tanks are placed in the upper wing between the spars, over the supporting struts from the fuselage. They are interconnected by a 3-4 inch steel tube carrying in its center a sight gauge, giving a positive record at all times to the pilot. Gasoline flows directly by gravity from tank to carburetor, using the hollow tubular flying struts as a medium; outlets being welded at upper and lower ends for hose connections. In a similar way a large hand pump, accessible from the cock-

(*Continued on page* 522)



A PRELIMINARY INVESTIGATION OF A NEW METHOD FOR TESTING AEROFOILS IN FREE FLIGHT

By F. H. NORTON

Summary

THIS report is a description of a new method of testing aerofoils in free flight devised by the National Advisory Commitee for Aeronautics. The method consists in lowering below a flying aeroplane a large inverted aerofoil on three small steel wires in such a way that the lift on the aerofoil always keeps the wires tight. The resultant force is measured by the tension in the wires, and the direction of the resultant by the amount the wing trails backwards. A test was made on an aerofoil of the N. A. C. A. No. 64 section, 6 ft. in span and the results are compared with a similar section tested in the wind tunnel. This investigation indicates that by the use of suitable recording apparatus aerofoils may be accurately and conveniently tested at a Reynolds number, a velocity and a degree of turbulence, comparable with that on the full-sized aeroplane. Satisfactory experiments were also made in trailing a sphere and a streamlined body on single wires.

Introduction

From the very beginning of the science of aeronautics there has been desired a satisfactory method for making tests on aerofoils and other aerodynamic bodies under the identical conditions of their use on the aeroplane. The wind tunnel and the whirling arm will give velocities equivalent to those of flight but the size of the wings that may be tested in this way is only a tenth or twentieth part of the full-sized ones. Attempts have been made to test full-sized wings when mounted upon a car or automobile but due to interference of the ground and to irregular winds the results have not been satisfactory and these methods have now been practically abandoned.

An attempt is made here to provide a method for testing full-sized, or nearly full-sized aerofoils at aeroplane speeds and under the same conditions of turbulence that are encountered by the aeroplane. The present investigation is, of course, only of the most preliminary character, so that the accuracy of the results is not high. The method, however, has been carefully studied, especially in regard to its inherent errors and the time required for making tests. Sufficient experience has been gained to justify the design of a new balance for use on a larger aeroplane.

Methods and Apparatus

The apparatus used for measuring the tension in the supporting wires is shown in Fig. 1. A heavy steel tube passes laterally through the fuselage and is connected by a pair of levers to a spring scale on the instrument board. On the center of the tube a windlass is attached for reeling up the wires passing to the wing. The two forward wires run outward from the windlass over pulleys at the end of the tube while the third wire runs backward and down through the fuselage. The angle of attack of the wing is changed by reeling in or out the rear wire while the others are held stationary.

The angle at which the wing trails back is measured by means of a reading telescope mounted on the side of the fuselage with a graduated circle. The vertical is indicated by means of a small pendulum. The pendulum although only slightly damped was very steady and would seem to be a very satisfactory method of indicating the vertical in uniform flight.

The angle of attack of the wing itself is measured by placing on the wing surface a liquid inclinometer which is viewed through the same telescope as used for measuring the angle. In this test the readings of the angle of attack were rather unsatisfactory due to the length of the bubble and to insufficient damping of the liquid; so the fluctuations were at all times considerable. Much better results can be obtained by measuring the angle of attack in the cockpit from the length of the wires.

The first aerofoil constructed was of solid white pine, and a few runs were made with it. As the weight of this aerofoil was considerable and as it was feared that it might do considerable damage to the aeroplane should it reach an angle of negative lift, it was considered safer to construct another one of light wood and fabric in the same manner as the usual type of aeroplane wing (Fig. 2). The forward wires are attached to the leading edge of the wing and the third wire is attached to the rear end of a wooden boom running backwards for about 5 ft. On the forward end of this boom there is a small vertical fin and at the rear end a large aluminum rudder, both for the purpose of giving directional stability. The area of these surfaces is probably much larger than there is any need of and wind tunnel tests will be made in order to determine the minimum size that may be used. The size of the boom is also much larger than required and its resistance can be at least halved.

When taking off and landing, the wing is drawn up close against the under side of the fuselage, a hole being cut in the fabric to take the upper part of the fin. When the aeroplane has reached a sufficient altitude it is throttled down to about 45 miles an hour and the windlass is slowly unwound, the angle of attack being gradually increased in order to correct for the change in direction of the air flow as the wing is lowered below the influence of the downwash. Incidentally, the angle and velocity of the air flow can be studied for any distance above or below a flying aeroplane by means of a trailing aerofoil. After the wing has reached the desired distance below as determined by a mark on one of the wires the aeroplane is held at exactly sixty miles per hour and readings are taken on the balance and with the telescope for various angles of attack. No difficulty at all is experienced in making turns with the wing hanging down, although no banks greater than 20° were attempted. Several runs were made with the wing in extremely bumpy air and although the wing swings around considerably, mainly in a lateral direction, there appeared to be no dauger of its getting out of control; but in making accurate tests it is quite essential that the air be smooth. After a test has been completed the wing is reeled up against the fuselage. Care has to be taken when gliding down to the field not to reach too great an air speed for the force on the wings may become dangerously large. Over twenty flights were made with this wing, the piloting being done throughout by Mr. T. Carroll of the Committee's staff.



A trailing wing in flight

Throughout the conduction of the tests it is necessary for the observer to use the utmost care that the lift on the wing does not reach such a small value that it can not be balanced by the weight of the wing itself. When using larger aerofoils than this one there would be great danger in such an occurrence as the fuselage or tail surfaces would very probably be seriously crippled. This danger can be guarded against by having an electrical contact on the balance set so that when the pull in the wires decreases below a certain safe value the angle of attack will be automatically increased.

The lift and drag on the aerofoil are given by the following expressions: where θ is the angle of trail from the vertical, W is the weight of the wing, D_1 is the effective resistance of the wires and supporting boom, and R the pull in the wires:

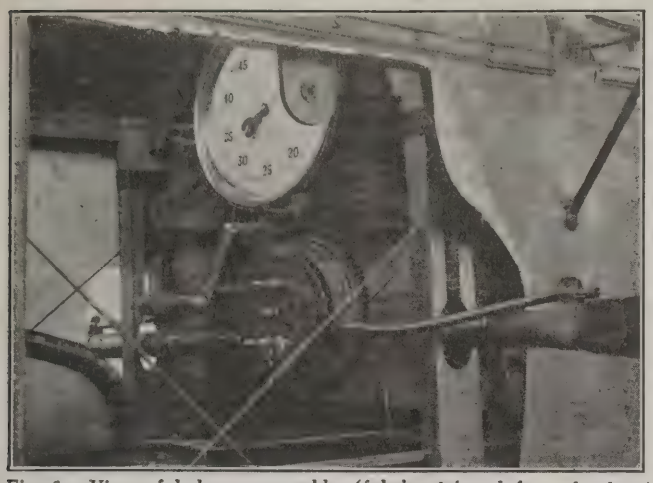


Fig. 1. View of balance assembly (fabric stripped from fuselage)

The lift and drag on the aerofoil are given by the following expressions: where θ is the angle of trail from the vertical, W is the weight of the wing, D_1 is the effective resistance of the wires and supporting boom, and R the pull in the wires:

$$L = R \cos \theta - W$$
$$D = R \sin \theta - D_1$$

Precision

The factors which enter into the computation of the lift and drag of the wing are the air speed, the tension in the wires, the angle of trail, and the resistance of the wires and boom. An experienced pilot can easily hold an aeroplane within one mile an hour of the given speed when the air is smooth, but if the air speed reading is recorded with each reading of the balance even a greater variation than this is of little importance. By calibration over a speed course it should be possible to measure the air speed of the plane to within ± 0.5 mile per hour. If we fly, for example, at 60 miles an hour this will introduce an error into the force readings of $\pm 1.5\%$.

The tension in the wires, as far as the balance itself goes, can be measured as closely as desired, the limit of accuracy being the steadiness of the load. In these experiments it was found that the spring balance vibrated quite rapidly over a range of from 5 to 10% of the absolute reading, although a mean reading could be taken to the nearest pound. It is thought that this vibration can be greatly reduced by using a suitable dash pot in the system. There is little doubt that the value of the resultant can be read to within one pound of its true value under all conditions.

The angle at which the wing trails back from the vertical may vary between 5° to 20°, according to the L/D of the aerofoil. It might be thought that a wing supported on wires 30 or 40 ft. below the aeroplane would make severe oscillations but when the air is smooth the wing remains so steadily in one place that it is almost impossible with the eye alone to detect any relative motion with the aeroplane. When the telescope is used a slight oscillation can be observed but this is so small and so regular that there is no trouble in obtaining a mean reading of the angle to 0.2°. An error of 0.2° in the trail angle will introduce an error in the drag about 3% when the L/D is at a high value.

The method of measuring the angle of attack in this experiment was rather unsatisfactory as the fore and aft oscillations of the wing, although small, produced a considerable longitudinal acceleration on the wing which made the bubble in the inclinometer vibrate back and forth over several degrees; so that an estimation of the angle of attack was quite difficult. It is believed that much better results can be obtained by calibrating the windlass in such a way that the angle of attack can be directly read from the cockpit. This would have the advantage in that it would allow the observer to set the angle to definite values each time. The angle of attack, however, is not of primary importance and, even if it was found that it could not be determined with accuracy, it would not greatly reduce the value of the test.

Another source of error which may be serious if care is not taken is the vertical direction of the flight path. By the careful use of a sensitive statoscope, levels should be maintained good to within 20 ft. in a mile which represents about 0.2°. Larger errors than this, however, may be introduced due to the rising and falling currents which are often present in the atmosphere. It seems probable, however, that rising and falling currents occur only when the air is bumpy, and as tests can not be made in bumpy air, it does not seem as if the errors due to rising and falling current would be troublesome. It is always advisable to fly these tests either early in the morning

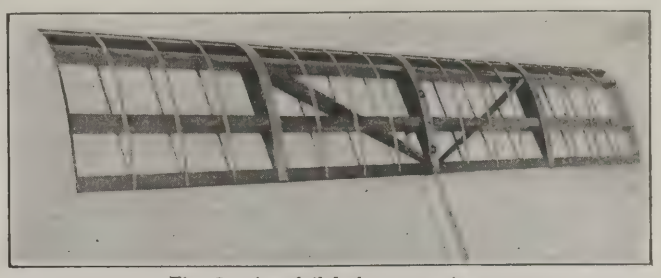


Fig. 2. Aerofoil before covering

or just before sunset, as the air at these times is almost sure to be smooth.

The true drag of the wing is the difference between the total drag of wing and supports, and the supports alone. It is evident that the greater the resistance of the supports compared with that of the wing, the more accurately must all measurements be made. It is probable that the resistance of the supports in free flight can be cut down to one-half the minimum drag of the wing. This is as small a proportion of support drag as is usually obtained in wind tunnel tests.

The drag of the wires and boom may be determined either by a wind tunnel test or by trailing them in flight. The latter method has been tried out and no difficulties were encountered. The interference between the boom and wing may be considerable and should be measured in the wind tunnel on a model.

Results of the N. A. C. A. No. 64 Aerofoil

A 12-inch by 72-inch aerofoil as described above was mounted on the aeroplane and a test was made with the wing about 20 ft. below the balance. The two forward supporting wires were each .002 inch in diameter while the rear wire was .015 inch in diameter. The drag of the wires and boom was measured by lowering the boom and wires alone and measuring the angle at which they trailed back at 60 miles an hour. In order to get the correct angle of trail the boom was constructed partly of lead. The oscillations of the boom were slightly greater than for the wing but a mean reading could be taken with considerable accuracy. The resistance of the boom and wires which varied of course with the angle of attack, amounted to two pounds at zero angle, which is approximately equal to the minimum drag of the wing itself. In this test no attempt was made to obtain the interference between the boom and the wing, therefore the drag as read is probably somewhat high, which probably accounts for the abnormally high L/D measured for this section. The actual time required in taking the readings on the wing (Fig. 3) was not over 10 minutes, and the time in the air (two flights) not over 30 minutes.

The results for this section are plotted in Fig. 3, together

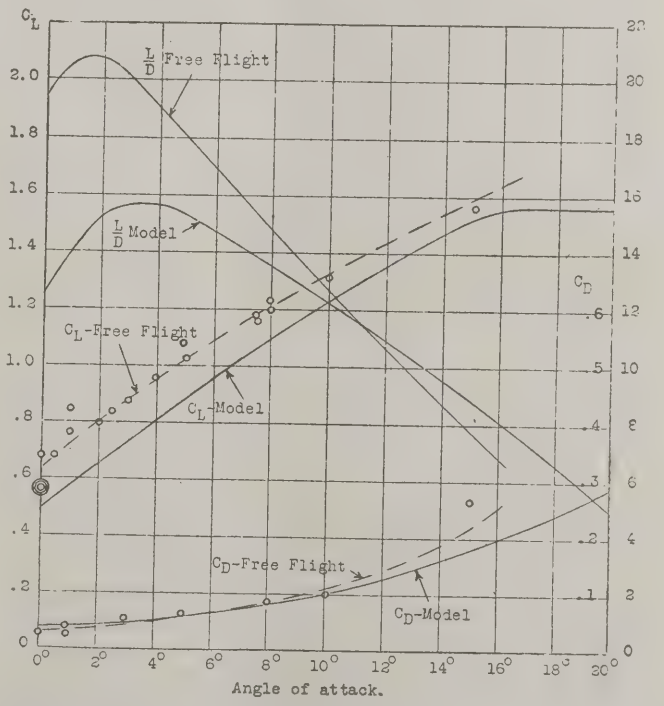


Fig. 3. Comparison of model and free flight tests of N. A. C. A. No. 64 Section. Model 3" x 18" at 30 m.p.h. Free flight 12" x 72" at 60 m.p.h.

with the test of a model of the same aerofoil in the wind tunnel. It will be noted that the lift curve although parallel to the model curve is considerably higher at all points. Except in a few cases, the observed points lie fairly closely to their curve. The drag curves lie very close together although the free flight values are somewhat lower at low angles of attack. Both the lift and drag curves show that the angle of attack in free flight was probably somewhat in error and that both curves should be shifted about a degree to the right. The maximum L/D in free flight is rather high, reaching a value of 21 as compared to 16 for the model test. While the increase in scale would be expected to increase the L/D to a considerable degree the free flight curve is probably too high due to the fact that the interference between the boom and the wing was not taken into account. These results are only of the most preliminary nature and no pretense is made for accuracy, but it is believed that rough as they are they demonstrate clearly the feasibility of this method.

Tests of Spheres and Streamline Bodies

In order to investigate the possibilities of measuring the drag of bodies in free flight, a bomb-shaped model and a sphere were each let down below the aeroplane on a single wire. The bomb oscillated considerably after changing speed or after turning; but if steady conditions were held it appeared as steady as the aerofoil. The sphere was equally steady and even though the test was made on a bumpy day, the trail angle of 18° could be read to 0.5° with ease. There seems to be no reason why the resistance of spheres up to 3 or 4 ft. in diameter can not be measured in this way with a high degree of accuracy. Unfortunately the time was not available for making any actual measurements with these bodies, but it is hoped that extensive work of this kind can be carried out in the near future.

Conclusion

The results from this investigation demonstrate that it is possible to make tests on large wings in free flight with a considerable amount of ease and accuracy. It is recommended that further work be carried out along this line on an aeroplane of greater capacity and on wings of larger size. In this connection a balance should be designed which will automatically record the air speed, the force on the wires, and the angle of trail for each angle of attack. It would also be advisable to record the force on the rear wire separately so that the moments of the wing could be determined. On the larger wings it will also be necessary to provide a power windlass for lowering and pulling up the wing and as suggested before an electrical safety device to prevent the wing from getting a negative loading. It is believed that if such a balance and apparatus is designed, wings of 30 ft. span and 5 ft. chord can be tested as quickly and accurately at a speed of 100 miles an hour as a small model can now be tested in the wind tunnel.

(Technical Note, National Advisory Committee for Aeronautics.)

LANGLEY FIELD WIND TUNNEL APPARATUS

By D. L. BACON

(Technical Note, National Advisory Committee for Aeronautics)

Part I.

Regulators for Speed of Wind Tunnel Drive Motor

SPECIALLY designed instruments regulate the voltage supply by a synchronous motor generator to the wind tunnel motor. This arrangement is capable of holding the motor speed constant to within plus or minus two-tenths of one per cent.

Desirability of Constant Speed

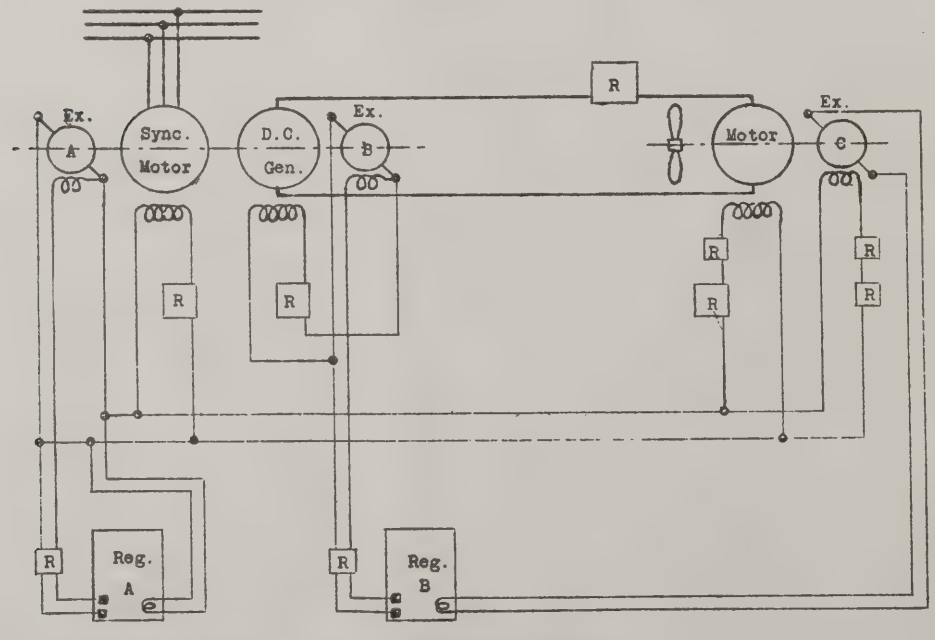
The accuracy of physical measurements and the time consumed in making them depend very largely on the magnitude of any fluctuations which may take place with respect to time in the quantity to be measured. If two or three observations of related quantities are to be made simultaneously, the time lag of the measuring devices and of the observers may be sufficient to introduce serious errors. If these fluctuations are of sufficiently short and regular period the mean value of the desired quantity may be estimated very closely by a skilled observer. If, on the other hand, the fluctuations are very irregular, varying both in period and intensity, accurate reading is impossible and much time is consumed in taking even approximate measurements.

Wind tunnel experiments often involve the measurement of three of four variables in addition to the air speed and as these are likely to be either square or cube functions of the speed, any large variation or uncertainty in the latter must be fatal to the efficient operation of the tunnel.

The main disturbances of air speed in a wind tunnel may be due to:

1. Changes in speed of the propeller shaft traceable to the source of power.
2. Turbulent and erratic air flow, including particularly the formation and breaking of eddies in the returning stream of air.
3. Changed resistance of the tunnel to the passage of air because of changed attitude of the model being tested, requiring change in propeller r.p.m. for same air speed.

The first of these must undoubtedly be corrected before the others can be successfully dealt with.



No. 1 Wind Tunnel - Power and Regulating Equipment.

Temporary Power Plant

During the first year of operation of the National Advisory Committee's wind tunnel, the only available sources of electric power were a pair of 25 Kw. gasoline-electric searchlight generators equipped with centrifugal governors and a 200-300 H.P. dynamometer driven by a twelve cylinder Liberty motor.

These supplied current at 250 volts to the wind tunnel drive motor, rated at 300 H.P. for one hour, with a base speed of 250 r.p.m. at full field strength; by weakening the field the speed could be raised to a maximum of 1400 r.p.m. Control was obtained through contractors and armature and field rheostats manipulated from the experimental chamber.

A Veeder liquid tachometer driven from the propeller shaft served to indicate variations as small as one revolution in 1000. It was thus possible to compare the relative steadiness of two sources of power with considerable exactness and without having to rely merely on the judgment of observers. Preliminary experiments showed that electrical measurements of the supply cur-

rent and voltage were useless as a means of comparing the steadiness of motor speed.

Original Speed Variations

The characteristics of the temporary power plant units may be given as follows:

The 25 Kw. generators when operated singly had a tendency to hunt, apparently due to faulty manifolding and to insufficiently rapid governor action. Although they could hold a nearly constant voltage when carrying a resistance load they were incapable of carrying the wind tunnel motor for a period greater than 30 seconds without its changing by at least 1% in speed while changes of 5% were frequent and 10% were not unusual. With both machines in parallel the fluctuations occurred more frequently but their magnitude remained approximately the same as with a single generator.

The Liberty engine, having no governor, was controlled by a mechanic who set the throttle to hold approximately constant voltage for changes in load. He made no attempt to follow slight changes in voltage while the tunnel was operating at a supposedly constant speed. When delivering 100 H.P. or over and with everything in first-class condition this power was occasionally very good, holding the wind tunnel shaft speed constant within ½% for considerable periods and somewhat closer than this for a few seconds. It had the serious disadvantage, however, of seldom coming back to its original speed after a fluctuation but of settling down to some new speed instead. This made it essential to keep a man constantly at the control rheostat prepared to correct the speed after each excursion. If any of the spark plugs fouled through long idling, which was frequently the case, the propeller speed usually became so erratic that the engine had to be shut down and the plugs cleaned before continuing the tests.

The Elimination of Variations in Shaft Speed

The new power installation* uses a 200 Kw. synchronous motor generator which is supplied from the local power-house four miles away by a three-phase, 60-cycle, 3450 volt line on which this motor generator set is the greatest load.

The control system is rather complicated in its detail wiring diagram but the accompanying schematic diagram will serve to illustrate the principles of operation.

The synchronous motor generator set is shown with two direct connected exciters A and B, while the exciter C is direct connected to the propeller motor shaft.

Assume the set to be running. Then exciter A, whose voltage is maintained constant by the regulator A, is seen to be furnishing constant excitation to the synchronous motor, the wind tunnel motor and the pilot generator C. This pilot generator by acting upon the solenoid of regulator B, governs the voltage of the exciter B and hence the field strength of the D.C. generator, the D.C. line voltage, and consequently the speed of the wind tunnel motor.

More explicitly: the voltage across the terminals of pilot generator C is proportional to the speed of the wind tunnel propeller shaft. If for any reason the r.p.m. of the propeller and motor drop off the voltage of C likewise decreases and actuates the regulator B to increase the field on exciter B and thus raise the voltage of the main generator which tends to restore the speed of the propeller to the original value.

The system is thus in a very stable state of equilibrium. To set the motor for any given speed the field of exciter C is adjusted to suit by means of the two rheostats shown in its field circuit.

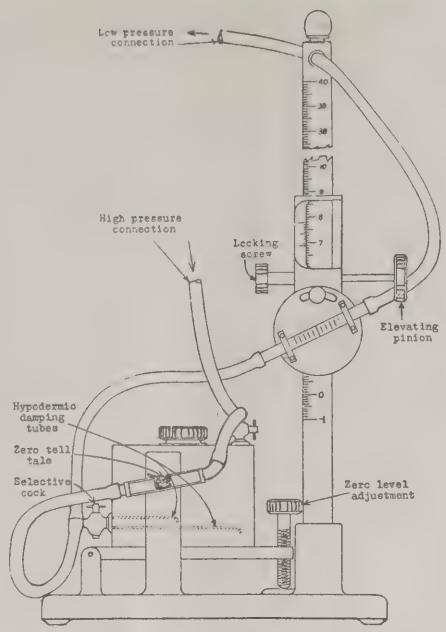
The regulator armatures are adjusted to vibrate, normally, about five times per second, which means that the speed correcting impulses occur with the same frequency. It is obvious that no disturbing influence can act for an appreciable length of time without engendering its own remedy. The apparatus as now adjusted suffices to hold the propeller speed constant to within plus or minus two revolutions per minute when running at 1000 r.p.m. and somewhat closer at lower speeds.

Further Improvements

The problem of obtaining practically constant propeller speed having been solved, there still remain the two other disturbing factors of erratic air flow and interference of the model with the air velocity. The methods used to eliminate these disturbances will be outlined in another note.

---

* This apparatus was designed and furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.



The Vernier Manometer

Part II.

A Vernier Manometer with Adjustable Sensitivity

In this instrument the air pressure is balanced against the head of liquid in a movable indicator tube, the height of which may be accurately measured relative to the constant level in a reservoir. It is portable, requires no calibration and may be adjusted for sensitivity and for damping.

Referring to the accompanying illustration, it will be seen that the gauge comprises a cylindrical tank or reservoir mounted on a frame hinged to the base plate and adjustable in height by means of a screw. The short glass indicating tube is mounted on a disc which may be rotated to incline the tube at any desired angle from the vertical in order to increase or decrease the sensitivity of the meniscus. The standard reference line, which in operation is made to coincide with the meniscus, passes through the center of this disc and forms part of a short auxiliary scale, the graduations of which correspond approximately to variations in head of 0.1 mm. (.004 in.) at the lowest angle of the indicating tube and of 2 mm. (.08 in.) at the highest angle. These are used only while observing small fluctuations from the mean head and permit the estimation of such excursions to 0.01 mm. (.0004 in.).

The frame supporting the indicating tube slides smoothly upon the square vertical rod and may be delicately adjusted in height by means of a small pinion meshing with a rack on the back side of the post. Sufficient friction to keep the frame from moving by its weight alone is furnished by a concealed spring of suitable tension, but the gauge may be locked against vibration or other disturbance by a thumb screw. Readings of the mean head of liquid are made by means of a centimeter scale graduated on the column and a corresponding vernier on the sliding frame, reading to 0.1 mm. (.004 in.).

A telltale glass fitted with a movable index is connected to the high and low pressure sides of the reservoir and immediately indicates any change in the zero reading due to expansion, leakage, or tilting of the base plate.

In preparing the gauge for use the vernier is first set at zero and then the reservoir is raised or lowered by means of the adjusting screw until the meniscus in the indicating tube is tangent to the reference line. The pointer on the telltale glass is then set to mark the zero level.

As the volume of liquid in the tubing is constant there is no change of head inside of the reservoir and consequently no correction is required for the relative cross sectional area of the indicating tube and the reservoir, as is necessary with the Krell type of gauge.

Provision is made for the viscous damping of fluctuations in pressure by means of a selective alcohol cock which either connects the gauge tube directly with the reservoir or through a short or a long section of hypodermic tube projecting from the cock into the tank, depending on the amount of damping desired. Damping through a needle valve is not considered satisfactory as errors may be introduced by a tendency to build up a pressure difference across the orifice.

TRAFFIC AIRSHIPS WITH SPECIAL REFERENCE TO ECONOMY

By WALTHER LEYENSETTER

(Translated by the National Advisory Committee for Aeronautics)

(Concluded from last week)

PART II

Introduction

Peace-time aviation can only be developed from economical view points. The general technical hypotheses were set forth in Part I.

We shall now discuss the matter of cost for its limited field of application and for its characteristic technical conditions, and endeavor to determine how an airship should be constructed, in order to fulfill the economical conditions of the purpose for which it is designed.

During the war, the constructors bent all their energies to increasing the total carrying capacity and total efficiency of aircraft, and if we should represent the progress made[9] by a curve as a function of the time, we could surely expect a smaller tangent for the curve during the next five years. Great improvements can not be expected in the immediate future.

The carrying capacity determines the useful load and the efficiency determines the cost of fuel. Consequently, we can not expect any considerable increase in the relative weight of passengers and freight, nor any considerable decrease in the fuel cost.

We must therefore devote our attention to the aircraft itself and its construction, while taking its short term of life into consideration. Statistics concerning the life of aeroplanes and airships have thus far been impossible.

The relatively high stresses on the essential structural parts of aircraft in comparison, for example, with locomotives and steamboats, constitute the chief reason for their short life. The strengthening of these parts at the cost of the useful load is largely impracticable and there accordingly remains, as the ultimate solution, only the lessening of the cost of construction by quantity production of exchangeable parts.

Experience has shown that the various parts of aircraft differ greatly in durability. While, for example, one part is only good for 100 hours of flight, another part may stand 6,000 hours.

Conditions demand the greatest possible standardization and, above all else, the manufacture of exchangeable parts. Economical quantity production in detail, however, is not at first strictly applicable to aircraft, since the machinery equipment of a factory would need to be adapted to each smallest part and process.

The application of this principle would enable the production of, say, 300 aircraft of the same type in a working day, a number for which there is yet no need but which may soon come within the realm of possibility.

We must therefore be satisfied with a compromise and endeavor to bring the fundamental requirement, the continuity of the supply of materials for making the larger parts of the aircraft into harmony with a definite yearly production of aircraft, for which there will always be a demand.

[9] In "Flight" of January 30, 1919, the English Air Ministry reports for the period from August, 1914, to August, 1918, an increase of 450% in the carrying capcaity of aeroplanes and of 55 and 790% respectively in the speed and endurance of airships.

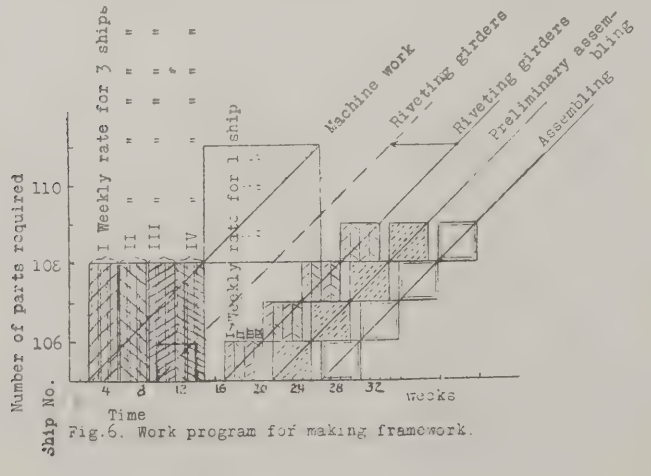


Fig.6. Work program for making framework.

I. Construction

The necessity of keeping the production cost of the airships low in comparison with the running expenses of the airship lines, leads to a deeper investigation into the methods of making the main part of a rigid airship.

In order to determine the cost of the three factors:

1. Materials,
2. Wages,
3. Overhead expenses,

in building an airship, the following exhibit of the bracing strips employed in the framework of a 55,000 cu. m. airship serves first.

Bracing Strips	Thickness in mm.	Number per Ship	Strips of Like Cross-Section	Number per Ship	Per Cent of Total number
a/b	0.4	3,300			
a/b	0.5	15,000	a	24,800	9.7
a/b	0.6	6,000			
b/b	0.4	11,000			
b/b	0.5	13,000	b	72,900	29.0
b/b	0.6	300			
c/d	0.4	150	c	150	0.1
d/d	0.4	150	d	450	0.2
e/e	0.4	8,600			
e/e	0.5	7,000	e	36,200	14.4
e/e	0.6	2,500			
f/f	0.5	1,100			
f/g	0.4	7,500	f	10,300	4.1
f/g	0.5	600	g	8,100	3.2
h/h	0.4	3,200			
h/h	0.5	1,100	h	23,850	9.5
h/i	0.4	15,000			
h/i	0.5	250	i	15,250	6.1
k/k	0.4	15,000			
k/k	0.5	5,200			
k/k	0.6	3,000			
k/l	0.4	4,000	k	52,900	21.0
k/l	0.5	2,500	l	6,500	2.6
m/m	0.4	150	m	300	0.1
		125,600		251,200	100.0

The variation of 0.2 mm. in the thickness of the sheet metal makes no differnce in the manufacture of the strips, so that it is seen from the last column that one kind of strip constitutes 30%, in a round number, of the total number of strips used

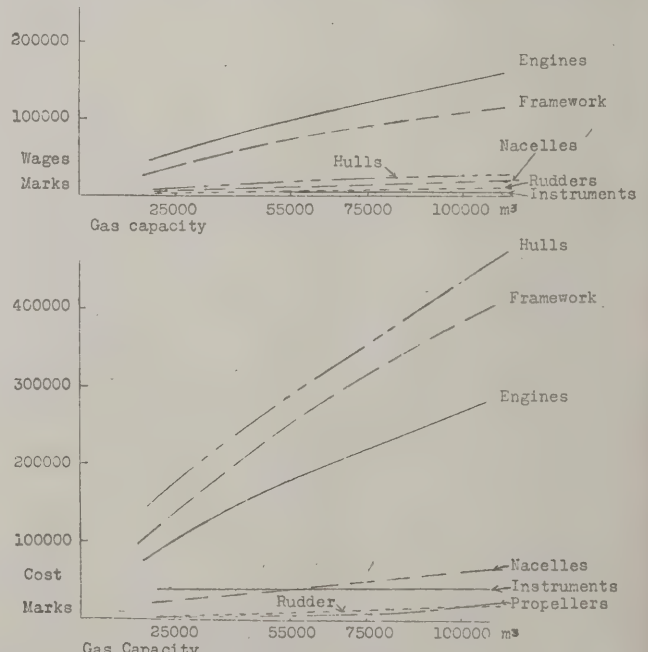


Fig.7. Wages and cost of materials.
(Wages on basis of Aug. 1, 1918.)

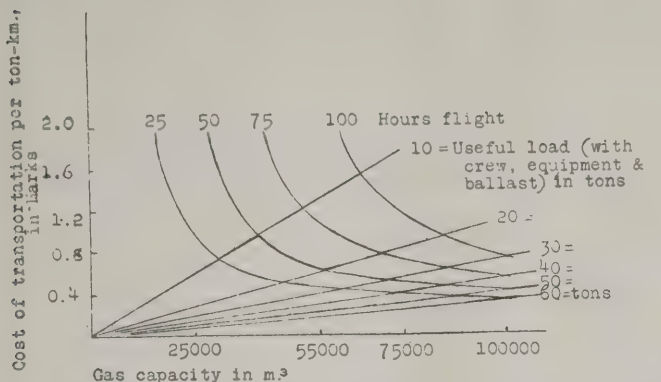


Fig.8. Cost of transportation per ton-km. on the basis of Jan. 1, 1919.

on the airship.

A day's output of a stamping machine consists, for both processes of cutting and stamping, of 6,000 to 9,000 pieces, according to the size of the strips.

If, now, the manufacture were conducted on the principle that he simplest part with its process determines the machine number for all the other parts, then for the strip 1, with a requirement of 6,500 strips per airship, a day's work would be reached and one airship would be completed every day.

A monthly output of 25 airships does not come at once into the realm of possibility. We must consider the relation between the total time required and the uninterrupted operation of an airship on the same part.

If, for instance, an airship is to be completed every month, then, as soon as one is removed from the assembling hall, all the materials must lie ready for the next, that is, the individual processes must follow one another in such manner as not to interrupt the movement of the materials, if another airship is to be completed on time.

If the processes involved in the construction of the frame[10] are divided into:

1. Machine work with unskilled operatives,
2. Riveting the girders,
3. Assembling the transverse frames,
4. Final assembling of airship,

it may be noted that the cutting and stamping of the strips and plates, as well as riveting the girders, constitute pure quantity production, since these operations are performed by unskilled female operatives. (It has been found that women are better adapted than men for such uniform mechanical processes which require no great physical exertion.)

In assembling the transverse frames, one-third of the work is done by mechanics and two-thirds by unskilled assistants; the final assembling of the whole framework, by one-fourth mechanics and three-fourths unskilled assistants.

Since, as already mentioned, it is impossible to perform all the work by quantity production, it remains to be decided where to draw the line between it and unit production.

If we hold to our program of completing one airship per month, then complete individual production with the four processes would require a period of four months, one month for each work shop to construct or assemble the parts for one airship. Any shifting in the order of finishing the individual parts would be entirely allowable and the strips stamped in the first workshop, on the last day of the stipulated delivery month, could be riveted to the girders in the next workshop any time during the next delivery month.

As soon as a change is made to the plan of adjusting one machine to the number of like strips required for several airships, then the work in all the shops must be done in accordance with a definite plan, determined in the supervising office, and no shifting is possible.

Since girders and transverse frames are bulky parts, it is advisable, for the sake of saving space, to construct them only for one airship, instead of for several at a time.

The time consumed affects the operating capital, since the longer the flow of materials continues, the more money is tied up. The uninterrupted operation of a machine is a source of economy.

The arbitrary production of an excessive number of parts incurs the risk of having a large number left over in case the particular type should be abandoned, while lacking parts must be made by expensive overtime work, both of which are highly uneconomical.

The same as for the framework, the work on the engines, nacelles, etc., may be systematically planned. Conditions here are more favorable, since more units of the same design are required per ship.

Many firms have introduced cost of production cards, on which every piece, together with cost of labor and material, as well as overhead costs and deterioration are entered.

Since the writer has no such system at his disposal, he found himself compelled to get at the cost of production in another way.

The weight of every individual part was deetermined for a series of airships. For every class of structural parts, a definite factor was obtained, as for example, 50% for lattice strips.

With the aid of carefully prepared weight lists the material actually consumed was determined. Multiplying this by the current prices gave the cost of materials.

In a similar way, the time required to make each part was found. Multiplying by the customary wages, and adding, gave the total cost of labor.

2. Establishment of an Airship Line

The economical adaptation of an airship to traffic purposes is demonstrated, when it shows sufficient advantages in comparison with competing means of traffic, due to its utilization of the air as a means of conveyance over both land and sea. The conditions are most favorable for airships in crossing a region of alternating land and water, thus avoiding the necessity of transfers.

In competition with existing land or water conveyances, airships have the advantage of speed, and the saving in time in going from one place to another determines the allowable increase in fare.

Assuming that aeroplanes in their present form have a maximum economical flight distance of 5,100 km., they will be adapted to establishing communications between places where the railroads make long detours and will supplement the latter, in a general way, like automobiles, but over longer stretches. They will also be employed where the deciding factor is the saving of time in comparison with the railroad or ship, especially where there is provision for emergency landings.

It would, however, be practically impossible for them to cross the Pacific Ocean without replenishing their fuel supply from mother ships which could be stationed at intervals of about 1,500 km. This accordingly constitutes the principal field of operation for airships.

Trans-Atlantic Traffic.—Even in flying over land, the airship has the advantage in its ability to carry larger and indivisible objects.

The distance an aircraft can fly depends on the four quantities:

1. Lift-drag ratio,
2. Rate of fuel consumption,
3. Efficiency of propeller,
4. Ratio of fuel weight to total weight.

It has already been mentioned that any considerable improvement in the first three is not immediately probable. It is furthermore evident that the ratio of the fuel weight to the total weight may be varied at will by changing the useful load. In this connection, the question of flight distance for economical purposes could be based on the ratio of *fuel weight to useful load.*

Instances may occur when it is a question of reaching a given point, at any cost, in the shortest possible time. A relatively small aircraft is better for this purpose when it is possible to make intermediate landings.

If a non-stop flight must be made, the flight distance for a giant aeroplane with two passengers may be

$$S = \frac{1}{k} \cdot ln\left(\frac{G_o}{G}\right) = \frac{1}{0.000156} \cdot ln\left(\frac{100}{62}\right) = 3130 \text{ km.}$$

Such exceptional cases can not however be taken as the basis for an economical calculation.

The preliminary conditions for the economical operation of an air traffic line must accordingly be:

1. Regularity of trips.
2. Nearly constant weight of passengers and freight.
3. Maximum transformation of engine power of fuel consumption into flight performance.

Conditions 1 and 2 depend on meteorological considerations

[10] The "Aeroplane" of August 20, 1919, describes the construction of the English rigid airship made of duralumin by the firms of Vickers Ltd., Armstrong, Whitworth & Co., Ltd., and Wm. Beardmore & Co., Ltd., as likewise of the wooden frame airships made by the Short Brothers, in Bedford.

The numerous illustrations show the individual processes in the construction of the airships and detailed descriptions picture the characteristic structural peculiarities.

The three operations: Riveting the girders, assembling the transverse frames and assembling the whole framework, are illustrated by pictures of the workshop with female workers, of the transverse frame shop with suspension devices and by many views of the assembling hall. An account is also given of the many subsidiary industries connected with airship building.

and the necessary remunerative load, while condition 3 is dependent on the construction of the aircraft and stationary adjuncts, and the economical production of both.

In discussing conditions 1 and 2, it is quite common to say that those portions of the earth which are inhabited by rich and enterprising men, do not have favorable meteorological conditions.

The union of Europe with North America by an airship line is most enticing to business men on account of the large commerce and passenger traffic between the two countries.

An inspection of the weather charts shows, however, that the regular operation of such a line the year round is not possible. Throughout the whole distance strong west winds prevail with great danger from storms during the months of September to April and much cloudy weather during the balance of the year. The most favorable months for the direct route between Lisbon and New York are June, July and August, since during this period there are spells of east wind and few clouds and storms south of the fortieth parallel of latitude.

Crossing the Atlantic with airships requires complete weather reports and the best weather predictions and radio-telegraphy. Generally, the direct route will not be chosen, but detours will be made according to weather conditions. In August, for example, the northeast trade-wind can be utilized by making a detour to the south.

Since there is room in this article to state only the most general preliminary conditions for the establishment of airship lines, I shall simply call attention to the fact that the Mediterraenan Sea and the Pacific Ocean are more suited to airship traffic than the Atlantic Ocean, and that consequently the lines London-Cairo-Australia, Cairo-Cape Town, and Francisco-Manila are very promising.[11]

[11] See "Segelhandbuch des Atlantischen Ozeans;" Schnell, "Der Flug über den Ozean," Motor, 1919, p 105; "The Aeroplane," August, 1919, p. 692, "Air Currents Over the Atlantic Ocean."

3. Costs of Operation and Upkeep

For determining the cost per kmt (kilometer-ton) the decisive factors are:[12]

1. Aircraft production and amortization.
2. Fuel.
3. Gas.
4. Accommodations for pilots and passengers.
5. Service, furniture, spare parts, repairs, etc.
6. Airdomes, hangers, mooring towers, and their amortization.[13]

The consideration of the relative value of each of the above elements would be too lengthy to take up here. With the present constantly changing values, the actual cost is less important than the relative cost for airships of different sizes.

It has been demonstrated that an airship should have a gas capacity of at least 75,000 cu.m. for a flight distance of 9,000 km.

The danger is still another obstacle to the popularization of air travel. In general, the assertion is true that travel by airship is safer than by aeroplane. Statistics of German prewar airship passenger traffic show 826 trips by four airships with a total of 17,221 passengers, and no accident. With skillful pilots great losses through accidents are not probable.

Still the airship can not be claimed to be a thoroughly safe means of transportation until danger of fire is removed by the substitution of helium for hydrogen.

Translated by the National Advisory Committee for Aeronautics

[12] In "Zeitschrift für Flugtechnik und Motorluftschiffahrt,'" A. Betz gives the running expenses in relation to the flight distance s and the flight speed v and makes the cost of the aircraft proportional to its weight and the price of the engine proportional to its power (HP).

[13] In "The Aeroplane" for August 20, 1919, the essentials for an airship are given as follows:

1.—An airdrome of 1.5 sq. km.; 2.—A hangar capable of holding two airships; 3.—A mooring tower with a windlass; 4.—A motor car on rails for conducting the airship from the tower to the hangar by means of an electric winch; 5.—Hydrogen plant; 6.—Repair shops; 7.—Meteorologic and radio stations; 8.—Electric signalling stations for night service; 9.—Offices, etc.

(*Continued from page* 515)

pit, is connected through another strut to the tanks which are quickly filled by this means when on the ground. The large size of these tubes ensures a very low velocity flow of gasoline through them, allowing foreign matter to collect in the bottom without passing over to the strainer. A plug below the outlet permits cleaning when required. It will be seen that all gasoline is in this way contained without the fuselage, and in the event of a nose-down crash of the worst kind, the tanks could not carry through without complete dislocation of the upper wing; and even in that event, would fall upon either side of the motor.

Landing Gear: The landing gear is of the conventional V-type constructed of steel tubing, as successfully proven in the HD-4. The application of shock absorber cord is novel, in that they are wrapped upon separate spindles, and applied as units to the machine, insuring correct tension at all times and simple maintenance in the field.

Motor Mounting: The motor mounting of the 10-cylinder Anzani in the HD-9A is identical with the HD-4, consisting of adjustable steel tubes extending from the forward bulkhead to a nose ring on which the motor is bolted. Four large pins connect the unions of these tubes to the four corners of the fuselage, making removal of the unit extremely simple, and allowing the motor to be swung backwards for inspection of carburetors and magneto, by drawing two pins on either side.

The engine mounting of the OX-5 in the "Petrel" is an interesting development of welded steel tubular construction, the fuselage proper is terminated at the fire shield with a solid bulkhead, upon which six large fittings are mounted. The engine mounting itself, made up in two halves right and left, is bolted to these fittings without the need of any cross wires or external bracing for support. It may be detached with the motor as a unit in case of quick changes on the field, while in the shop the motor can be slipped into place along the bearers without having to remove carburetors or any accessory fittings, an excellent example of attention paid to details of maintenance and repair as applied to commercial work. The cowling is hinged aft of the motor, top and bottom, so that it may be raised, or lowered, entirely out of the way, and yet not require complete removal and the likelihood of being kicked about upon the ground.

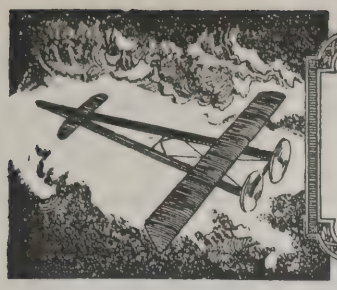
General: It will readily be seen from this brief description that both machines follow closely the fundamentals that were developed in the first Huff-Daland machines of the HD-4 type as training planes for the U. S. Army. Sturdy, simple, construction was the keynote of design, for in training, just as well as in commercial work, the ability to stand up in service, and offer a simple problem for repair, is of far more importance than the adding of a few additional miles to the high speed, at the sacrifice of more important details.

Simplicity in this sense has really a threefold meaning, simplicity of construction in the first place permitting easy production methods and resulting in a moderate priced prod-

(*Concluded on page* 531)



Showing the wing construction of the Huff-Daland 9A



ELEMENTARY AERONAUTICS *and* MODEL NOTES



CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

THE JUNIOR CLUB OF AERONAUTICS,
KANSAS CITY, MO.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

A Seven-Foot Model of the Lawson C2 Aeroplane

The model shown in the illustrations below was constructed by S. Petroff of Milwaukee, Wisconsin, who has been closely allied with the auronautical industry for the past four years, associated with the Lawson Airplane Co. until June 1st, 1920, and since that date with the Hamilton Aero Mfg. Co. of Milwaukee.

The detail has been worked out very faithfully, even to the smallest of parts and in most every detail, accurately represents the Lawson C2 which made the successful flight from Milwaukee to New York and return in 1919.

Using spare moments, the constructor completed this model in twenty-six months, which would imply the great amount of detail involved in the construction.

Its span is 7' 2½"; overall length, 48½"; chord, 10"; gap, 10"; height overall, 18"; weight, 28 pounds.

Two electric motors of 1/16 H.P. each are located in the nacelles and turn 10-inch propellers.

There is a complete installation of running lights and the cabin is lighted with six miniature electric lights obtaining current from the commercial 110-volt circuit through a transformer.

Nineteen chairs are installed in the cabin in which are seated small dolls to represent passengers. The cabin is completely upholstered in green velvet, and painted outside with white enamel.

The pilot's cockpit, located in the forward upper part of the cabin, opening through the roof, is reached by circular winding stairs from the main cabin. Controls are dual and semi-Dep.

All the materials used in its construction are the same as used in the large planes, except that the planes and tail surfaces are covered with silk, which is doped and varnished in the orthodox manner.

The model was only recently completed and is to be displayed in one of the large department stores of Milwaukee.

Pacific Model Aero Club Notes

Mr. Hubert A. Burgess, president of the Pacific Model Aero Club, San Francisco, recently made a trip to Seattle, Wash., in order to take part in a revival of interest in model aeroplanes in the latter city. Mr. Burgess sees great possibilities in the model game and believes it is practically the only way to interest the younger generation in aviation, and that if men who are up in the aeroplane world would realize this and assist in the organizing of stronger model clubs throughout the country, an amazing boost would be given the science of aviation.

On the Pacific Coast, Raymond C. Hansen (Secretary of the P. M. A. C.) and Mr. Burgess are endeavoring to establish real, live, active clubs in Seattle, Portland and San Francisco. Mr. J. Clark has charge of the Portland Club and did excellent work during the past year.

Besides the officers mentioned above, the other officers of the P. M. A. C. are: Dan S. Tuthill, Treasurer, and Richard Burgess, Director of Activities. The Club's headquarters are at 23 Palm Avenue, San Francisco, California.

Huntington Monoplane With Lawrence Engine

A modification of the Huntington monoplane design, calling for a 2 cylinder opposed Lawrence engine, has been draw up by Mr. D. W. Huntington for a client desiring the general characteristics of the original design, but with a higher speed and faster climb. From the design data the following weights and performances are calculated:

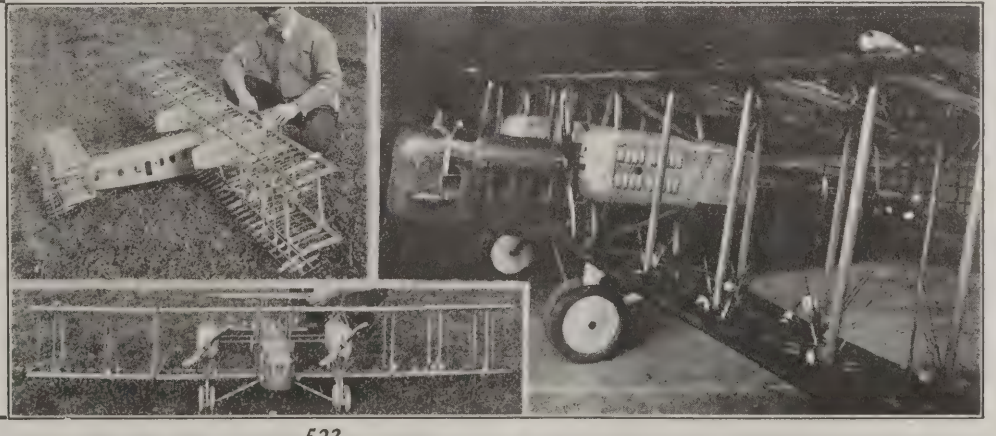
Weights

Machine empty	270 lbs.
Fuel and oil	40 lbs.
Pilot	150 lbs.
Total wt. full load	460 lbs.
Wing loading sq. ft.	5.75 lbs.
Power loading hp.	18.6 lbs.
Factor of safety	7.5

Performances

High speed sea level	78 M.P.H.
Cruising speed	58 M.P.H.
Landing speed	37 M.P.H.
Range, cruising speed	230 Mi.
Initial climb	700 ft. per min.
Ceiling	10,000 ft.

A seven foot model of the Lawson C-2 Twin-motored transport aeroplane, accurately built to scale by S. Petroff



FOREIGN NEWS

Canadian Air Board Figures

The Canadian Air Board announces that there were in force on Sept. 30, 1921, 58 private air pilot's certificates, 86 commercial air pilot's, 151 air engineer's, 1 air navigator's, 58 civilian plane certificates, 30 civil Government, and 59 Canadian Air Force. Twenty-five licenses were in effect for civilian air harbors.

Big Air Force for Japan

Heads of the Japanese navy, faced by the decision of the arms conference at Washington to cut Japan's naval strength in accordance with the 5-5-3 ratio, plan to give the Mikado a great air force of 156 planes, six balloons and four airships. In the words of Captain Kikutaro Takahashi, Director of the Aerial Bureau of the Naval Office, Japan "will insist on at least the same aerial strength as England or America."

Japan has at present only one airplane carrier, the Wakamiya, with a displacement of 5,875 tons, but when her new vessel of this type, the Hocho, is launched, she will rank next to England in number of carriers, America being third with one. It is pointed out here, however, that the United States has two carriers under construction, larger than any owned or projected by England or Japan.

Discussing the aerial situation, Captain Takahashi said:

"When plans now in hand are completed, Japan will occupy fifth place among the powers. However, we are contemplating construction of three or four more airplane carriers. Our geographical position necessitates an increase in our aerial strength, which we will insist on keeping at least equal to that of England or America."

Italian Contests

The Minister of War has approved the proposal of the High Command for Aeronautics to hold two flying contests during September, 1922, the Tyrrhenian Cup and the Italian Grand Prix. There will also be a parachute competition with prizes of 500,000 lire and a balloon contest with prizes of 30,000 lire. All the above events are international. In order to encourage those aircraft constructors whose machines do well in the contests, the Ministry of War has set aside 400,000 lire for the acquisition of these machines, which will then be handed to the civil aviation companies by way of subsidy for the operation of civil air services.

Casualties in Italian Aeronautics.

During the period from February 1, 1921 to the end of August, 1921 (7 months) there were 16 airplane accidents in the Italian Army Air Service, resulting in the death of eleven pilots or observers. The report on these casualties states that most of them occurred to student pilots, or when they were being carried, and may therefore be attributed to them, for, according to the testimony of eye witnesses, the accidents were due to errors in maneuvering. Such accidents cannot, therefore, be attributed to defective material and still less to defects in the motors.

German Machines Destroyed

From Berlin the figures given for aircraft destroyed, etc., up to October 1st last are 12,471 aeroplanes and 20,364 aero engines destroyed and 629 aeroplanes and 3,632 engines surrendered.

Air Mail in Colombia

Vice Consul Edmund B. Montgomery, at Barranquilla, reports that at the present time the Colombian Government is subsidizing the weekly aerial mail service of the Colombo-Alemana de Transportes Aeroes between Barranquilla, Girardot, and Nieva to the extent of $100 per trip, plus a payment of 30 cents per 15 grams for mail carried. The company has five hydro-aeroplanes with 500 h. p. motors, carrying 3 passengers each.

Mail transportation by river steamboat takes from one to two weeks going from Barranquilla to Bogota, depending on the condition of the river, whereas by air service it arrives in 24 to 30 hours. American business men desiring to make use of this fast service to interior points in Colombia can purchase stamps in New York City at Vasquez Correa & Co., No. 1 State Street.

On the 23d of October the service was extended to include a weekly trip from Barranquilla to Cartagena, leaving Saturday and returning Monday. The aerial postage is 15 cents for each 30 grams, and the passenger fare is $50 Colombian currency.

Flying Conditions in China

Air Service officers returning from leave in North China report conditions ideal for the development of aviation. North China has great areas of level open country. Fortunately for aviation, the Chinese live in communities, so their mud houses are not scattered over the country side, but collected in small groups behind a stone wall. Graves of the millions of Chinese dead are scattered promiscuously over the countryside and obstruct many otherwise perfect sites. They also reported weather conditions ideal in Peking and Shanghai during the months of October and November.

Woman Aviator Killed

Stockholm—Elsa Anderson, the only Swedish woman to hold an aviator's certificate, was killed at Askersund Jan. 22. Four thousand spectators were watching her make a flight and were horrified when Miss Anderson, in attempting a parachute descent from the machine, fell like a plummet to the earth.

The parachute failed to open, and she plunged 2,000 feet to death.

German Gliders for Britain

As a direct result of the interesting experiments crarried out in the Rhön Mountains in Germany during last summer, considerable interest is now being taken in the problems of gliding and soaring. Not only are the German experiments to be continued this year, but France has planned a gliding competition also. In England, although judging from the number of enquiries which have been received, there is considerable interest in the subject, nothing definite has been planned. The chief reason for this is probably that the problem of constructing scientific gliders has not hitherto received any attention here. We now learn, however, that the Aachen glider on which Klemperer remained aloft for 13 minutes may be introduced in this country if sufficient interest is found to exist. The agency for this type of glider has been acquired by Mr. J. T. P. Jeyes, of 38, The Crescent, Northampton, who will be pleased to give further information relating to the details of the Aachen glider.

Egyptian Disturbances and Aeroplanes

A very effective measure to cope with the disorders in Egypt was, under martial law, announced last week in Suez, as follows: "If aeroplanes perceive an assembly they will drop smoke bombs; if the assembly does not disperse they will drop shells and open fire with their machine-guns."

Controversy Over Michelin Cup

According to reports from Paris, events in connection with the Michelin Cup have taken an unexpected turn. The performance put up by the Italian aviator Capt. Martinetti over an Italian circuit of 3,000 kms. has, the report states, been disputed by the French Aero Club on the grounds that Martinetti, they allege, failed to land at his point of departure after terminating the flight. There is also some talk of Martinetti having changed machines in the course of his flight, which is, of course, contrary to the regulations. It is not to be expected that the Italian Aero Club will accept this decision straight away, and probably some lively correspondence will follow during the next few days. If the reported decision of the French Aero Club is to stand, Poirée would appear to be the holder of the Cup for 1921, his performance having been the best French one, with an elapsed time of 37 hrs. 23 mins. In the meantime French aeronautical journals are suggesting that the regulations should be altered and the competition held during the summer months so as to avoid the danger of the autumn fogs.

Paris-Constantinople Line Initiated

The two French pilots, MM. Deullin and de Marmier, have just completed an out-and-home flight between Paris and Constantinople, by way of blazing the trail for the regular service to be started later on. Leaving Paris on October 10 last, they covered the distance of 1,770 miles between the two capitals in 17 hours' actual flying time, having made long halts at Strasbourg, Prague, Budapest, Belgrade and Bukarest. They left Constantinople for home on November 7, and de Marmier arrived at Le Bourget on December 22, his flying time being 18 hours. Deullin stopped at Nancy the same day. It is proposed to inaugurate a regular service shortly.

Siam and Aviation

During his "round-the-world" journeying Lord Northcliffe made a stay at Bangkok, and on December 23 he visited the aerodrome at Don Muaung, where Sir Ross Smith alighted during his Australian flight in 1919. *The Times* correspondent states that Lord Northcliffe was surprised to find the air station equal to most of those in Europe.

Siam, he states, has 25 landing-places and five aerodromes. At Don Muaung there are 115 planes, including school machines, and a staff of 650 men.

It looks as if there should be a good opening for British development in this land of promise.

A New Peugeot Prize

As was announced at the time when Gabriel Poulain won the original Peugeot Prize by hopping ten metres on a winged bicycle, M. Peugeot has offered a further prize of 20,000 francs for an increased performance of the same kind.

The new prize is to be won by the first man-driven aeroplane which covers 50 metres once in each of two opposite directions over a flat surface. The use of any gas lighter than air to aid in lifting is prohibited.

The competition is open to all nationalities except Germans, Austrians, Turks, and Bulgars. Entries should be made to the Maison Peugeot, 80 Rue Danton, Levallois Perret, Seine, accompanied by an entrance fee of 10 francs.

Wireless Telephone Aids Aeroplane Service

The successful operation of the wireless telephone across the English Channel has made possible continuous communications betwen English shore stations and flying craft in the Paris-Brussels service, and is particularly helpful in a heavy fog.

An air traffic control tower at the aerodrome has been linked up with an extension from the wireless station and so arranged that a wireless operator can plug the air controller through on a wireless telephone to any air express on the wing, with the result that any urgent orders or explanations of conditions at landing fields can be conveyed to pilots.

The wireless tower at the aerodrome also has proved a great help to pilots who are landing in rain or fog, for the operator can communicate with mechanics in the field by means of a megaphone as the aeroplanes are coming in. The system has served further to eliminate danger from the Channel air service.

Air Traffic at Bourget, the Paris Air Port

Of considerable interest and importance are the figures now available for the past year's growth of flights and passengers and freights carried. For the month of December, the figures are: 148 flights (arrivals and departures), 359 passengers, 7,277 kilogs. of freightage, and 84 kilogs. of mails. For the full 12 months to December 31, 1921, last (compared with 1920) the figures are: Flights, 4,022 (3,359 in 1920); passengers, 13,369 (6,850 in 1920); goods, 150,309 kilogs. (120,745 in 1920); mails, 3,308 (1,474 in 1920).

These figures are for the airways in operation between Paris and London, Paris-Brussels-Amsterdam, Paris-Strasburg-Prague-Warsaw, Paris-Amsterdam and Paris-Havre.



The Aachen Soaring Monoplane

By H. J. Nordman

Member of Long Island Flight Association

THE soaring plane which showed the best performance the second annual soaring plane contest held in the Rho District of Germany was the Aachen monoplane.

The machine was constructed to the designs of Engineer Klemperer and by the members of the Technical Flight Society of Aachen. Most able assistance was also rendered by Professor von Karmen of the University of Aachen in testing the aerofoils and doing practically all the aerodynamical research work in the university laboratory.

During the contest, Klemperer soared a distance of 8,514 feet, remaining in the air for 271 seconds. When the contest was over, however, Klemperer made a record-breaking flight of 13 minutes duration. At times his altitude was estimated to be 300 feet higher than the starting point. His course covered about 6 miles, during which he made many curves and even "figures 8"; the straight-line distance between starting and landing points was about 3⅛ miles.

Some of the features that were considered of fundamental importance in the design of this machine were large lifting surfaces for the purpose of utilizing upward air currents, large control surfaces that could be easily operated, and a pronounced dihedral angle on the wings for stability. These factors led to the choice of a cantilever monoplane from the wings of which protruded a landing skid arrangement.

The fuselage is of the regular trussed girder type. The dead area or head resistance is decreased to a minimum by carefully streamlining the entire machine. The material used is chiefly thin wood veneer. On the entire machine, wires, cable and steel fittings are eliminated, with the exception of the section for dismantling the tail structure where aluminum clips are used. The landing skid shoes are also shod with sheet aluminum and the trailing edges on the wings and tail consist of a thin cable. On all wood joints cold glue was used.

The main structure consists of the wing skeleton around which the entire machine is built. The wing structure and the fuselage, which is parted just back of the pilot's cockpit, forms a unit. The rear half of the fuselage and the tail surfaces form another unit. This is done to facilitate transportation.

In order to amply reinforce the wings, three beams are used. They are of box-girder and I beam section, constructed principally of thin wood veneer and lightened as much as was practically possible. The main or center beam has a factor of safety of five and is capable of taking the entire load. This beam with a span of 30 feet has a total weight of 16½ lbs.

The rib profile is similar to the rib used in the Junkers monoplane. The rib at the wing root has a length of 6 feet 4 inches with a maximum depth of 16½ inches. The eighteen ribs weigh 8¼ lbs. The ribs are so constructed that they can be slid over the wing beams. Each rib is of I beam section and the cap strips consist of a thin strip nailed and glued on each side of the web, similar to Fokker practice.

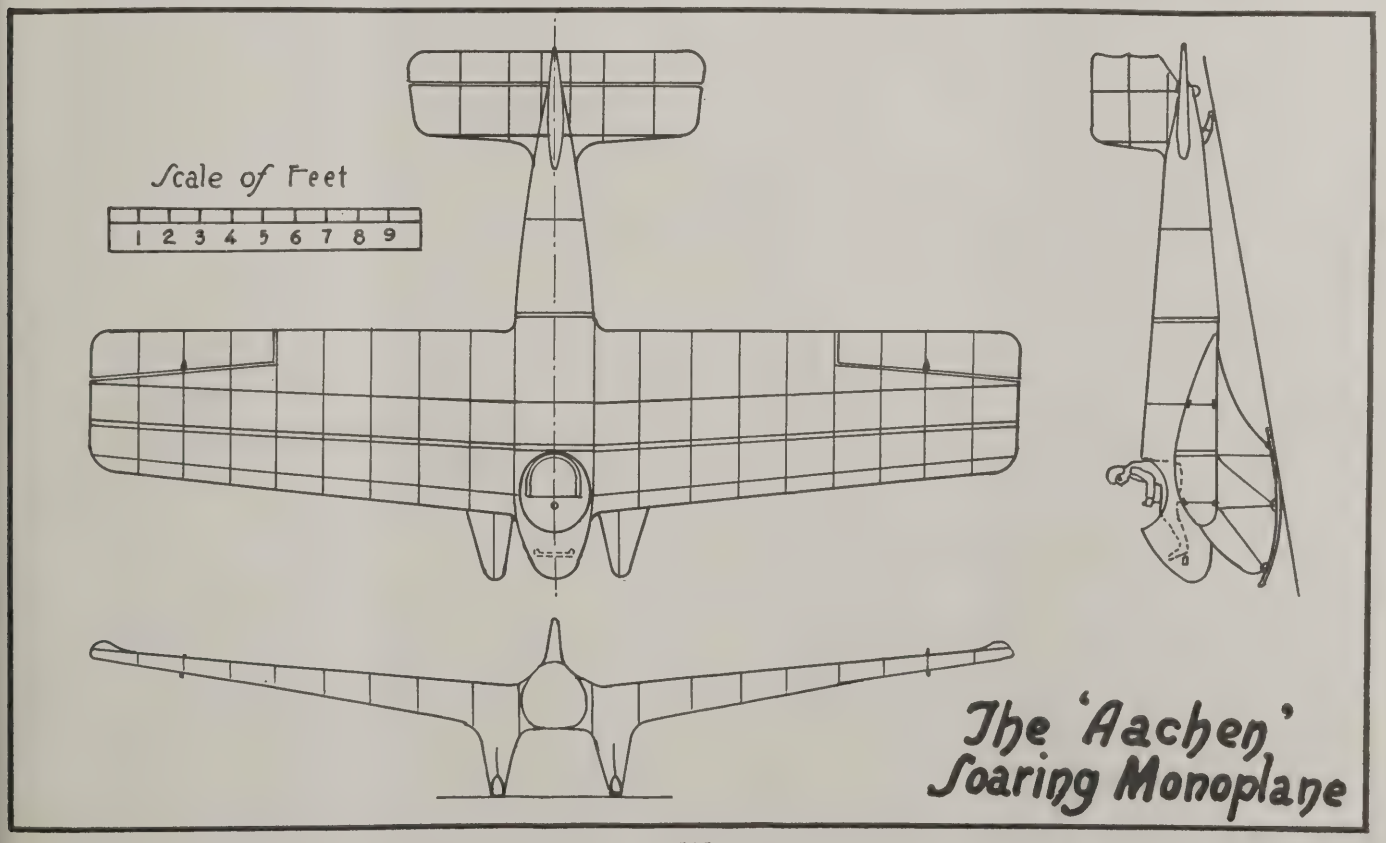
The wing nose is reinforced with cardboard. Instead of internal drift wire, a strong tape of cloth is used. This tape is so arranged as to also take care of any torsion that would be produced in the wings in flight. The wings are set at a very pronounced dihedral angle and slightly arched, birdlike, near the center. The plan view is trapezoidal in shape.

One aileron weighs 1.92 lbs. The entire wings have an area of 162 sq. ft. and weigh 53 lbs. The wing covering consists of a very light weight black Voile impregnated with cellulose dope, the dope weighing 2 ounces per square meter. The dope possesses good weather resisting qualities.

The pilot's seat is located between the front and center beam. The control stick is made of duralumin and weighs .35 lbs. and the pedestal and handle grip weighs .17 lbs. The pedestal is made of wood veneer. The foot bar is also made of veneer and is hollow, reinforced with aluminum foot guards.

The fuselage nose is made of bamboo and so built as to act as a shock absorber in the event of a nose dive. The section of the fuselage behind the leading edge of the wings is built of thin veneer. The landing skids are also built into the wings, of streamline section and internally braced. The skid shoes are made of aluminum with rubber shock absorbing cushions. The protruding landing skid offers no interfering influence on the stability of the machine.

(To be continued; next article to have detail photograph)





To-Day and Memories

Diverging paths now lead you out,
Where peace-time grafts plot the route;
Still, for the bird who loved the game,
Old memories find, and fan, the flame.

You live again the training-days in France,
Where frontline hopes held you entranced;
Through surried days, till darkness claims the sky,
An Austin or an Osgood shows you how to fly.

Again you feel the kick and thrill,
As "orders" ferry you from Orly to the kill;
To hear, "returning, keep the sun on right,"
Where Latour or Little head the flight.

Out of the scrap, the bunch come, straggling low,
At check, perhaps, your pal has failed to show.
"Turned loose," to join Yank souls beyond the fray,
A Luke or "Silent" Bruce earns the Great Lachĕ.

The past may dim as robbing years close down,
Where life's hard grind chalks you "on the ground";
Still, for the bird who knew and loved the sky,
Clipped-wings don't bar where Memories fly. *A. A. C.*

The Bluejacket's Manual

Q. What is the twofold nature of your duty in the Navy?
A. First, my military duties, that is, to wear my hair at least four inches long, and to tuck my C. P. O. dickey out of the O. O. D's sight while going on liberty. Second, the duties of my specialty, that is, to become proficient in jazzing, shimmying, and finding the cafes that stay open after 2 a.m.
Q. What does the Navy offer?
A. A place to eat, sleep, and rest up, after going A. O. L.
Q. What are the different types of naval courts martial?
A. Twenty days, three months, and Portsmouth of "Eighty-four."
Q. Give some general remarks on pay.
A. 20th, nothing on the books (allotment—Mrs.); 5th, nothing in the pocketbook (entertainment—Miss).
Q. What are the rules concerning salutes?
A. Look the other way.
Q. What are the general characteristics of ships in the Navy?
A. Hammocks, mess tables, pay offices, gangways.
Q. Give some general features of ships of the Navy of different classes?
A. Battleships, bugles, destroyers, bunks, dungarees and hospital ships.
Q. Give the routine in port and at sea?
A. At sea: Breakfast, dinner, supper, hammocks. In port: Breakfast, dinner, liberty.
Q. What are the aim and object of all general drills?
A. Aim: To stand at quarters waiting for "secure." Object: Yes.

The Pilot's Parting

My ship 'tis done, and so we part for aye;
Henceforth the friendly, deep, blue, wide-eyed sky
Shall wait in loneliness to see us go,
A-tilting 'cross its broad expanse as though
The fleetwinged feet of Mercury were there.
'Tis done:

Now bare as desert sands the air
Shall be; and none will hear the sobbing drone
The cold wind makes up there unknown, alone;
And now the silent clouds must plow their way
Across the sky unstartled through the day
By you and me.

No more we'll take that path
That we were wont to mount up when our wrath
Was kindled by some bold, audacious Hun,
Who dared defy our purpose. No! and none
Will see again that last, that deadly, dive
Or watch him frantic, twist and turn and strive
To 'scape the chatter of our "Lewis" there,
Which pointed steely finger at him where
He crumpled down beneath our fire.

For now
The end. Now upward, toward the sun, your prow
Will point, a-tremble with that wrath, no more
That wrath which drove your enemies before,
That wrath which sent you leaping skyward, up
Until your wild ambition reached the cup
Of your success; until your form was feared
By all your foes, until your wings were cheered
By every friend.

So now your duty's o'er;
And shall you lie and rest, and dream, and soar
In only memory?

Shall I again
O'er dusty books now pore, as I did when
The call for you and me was made?

Ah, ship
Of mine, e'en though no more at night we'll slip
Along the silent sky-walls, grim and black
To hurl our bombs upon the crouching back
Of some far-distant war plant giant, raw
With redeyed haste to feed the greedy maw
Of battle-hunger, yet, yet will this free.
Wide world, above the patchwork earth we see
And feel apart from, flying high, be lost
Because these guns and bombs of ours which cost
So much to them who have opposed us, stand
Now mute? A tale of wrong made right.

So grand
A past must turn the thoughts ahead; so much
We did in that wild war, which gave us such
A place is but the start.

Again we'll shear
The wind, and high above the saucer-world
Your wings shall sing once more, and we'll be hurled
Along by whirring, dim, propeller blades,
Above, and who can tell what swampy glades,
Or unknown seas, or mountains stretching there
Full height, to grasp us as we pass. Oh where
Is he, who with a seer's eye, can tell
What frontier towns, what gasping speeds, or well
Commended freight-loads we'll attain, when called
To over-crowded marts, and ports space-thralled,
By needy Commerce of the World?

Ah, friend
A little while I'll leave you now to lend
My presence otherwhere; but lie in wait,
For soon I shall return.

Soon shall the late
Wild scene of battleair become the street
Of traffic—Highway of the World. Then fleet
Your wings and skilled my hand, we'll guide and hold
A different cargo. Where we once were bold,
We shall be now the swift; where once we were
The Vanguards of Destruction, now we'll purr
Through peaceful skies, your fleet wings hurled
To do the many errands of the World.

Hart Jenks.

The Seasons

The teacher of an East Side schoolroom had been telling the class about the four seasons. Then she began her questioning:

"How many seasons have we?" she asked Rachel.

"Two, miss," replied the little denizen of New York's sweatshop district, "slack and busy."

Watchful

Shopper (looking at socks)—"Aren't they rather loud?"
Shop Assistant—"Yes, sir. They are specially made for people whose feet are in the habit of going to sleep."

Aerial Photographs

WE are always in the market for good aerial photographs, and we invite our readers to submit to us aerial views of landscapes, seascapes, forests, mining regions, etc. Address: Photo Department

AERIAL AGE WEEKLY
280 Madison Avenue **New York**

(*Continued from page* 522)

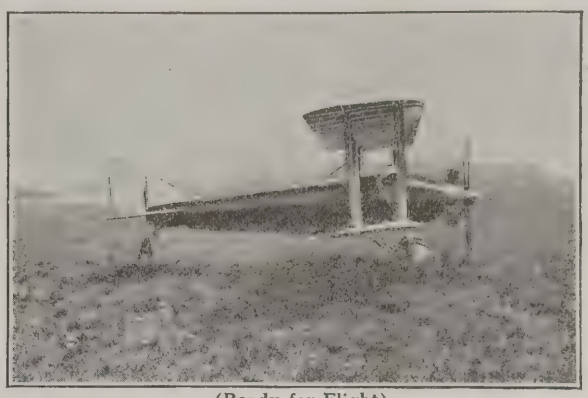
uct. Simplicity of assembly and maintenance in the second place where the removal of unnecessary wires and fittings is an important feature. As an example of this it is interesting to note that the HD-9A was assembled, lined up, and in the air two and one-half hours after its removed from the car in Dayton. Simplicity, lastly, of repair is perhaps most important of all for the replacement of delicate wood, and special steel fittings, with fewer and larger parts obtainable from common sources, has been followed through to a large extent.

Performance: During flight test the characteristic high lift qualities of the thick wing sections at high angles of incidence was demonstrated to a marked degree. In coming into a stall landing, it was found that the machine could be rolled up almost indefinitely without the usual sharp break in lift, when a certain angle is reached. As a result of these tests, the angle between wheels and skid has been increased over the first model, assuring an even slower landing speed when required. The slow flight sped, however, allows a very quick takeoff, the combination resulting in unusually good qualifications for cross country flying.

General specifications of the "PETREL" as produced for commercial work follow. Dimensions of the HD-94 are identical to this. The weight, light, is somewhat less due to lighter motor and heavier mounting. Loaded with two passengers, two and half hours fuel, and Standard Army Equpimetn, the gross weight is 1,710 lbs., giving 17.1 lbs. per horse-power with the 100 h. p. Anzani motor.

Specifications
"Petrel" HD-8A

Span—upper	29 ft.
Span—lower	21½ ft.
Length over all	24 ft.
Height over all	9 ft.
Chord—upper	5½ ft.
Chord—lower	4 ft.
Stagger	10¾ inches
Gap (mean)	4½ ft.
Incidence (upper and lower)	0 degrees
Wing section	Göttingen 387
Rudder area	8½ sq. ft.
Fin area	7½ sq. ft.
Stabilizer area	20½ sq. ft.
Elevator area	19½ sq. ft.
Aileron area	11½ sq. ft.
Total wing area	227 ft.
Weight light (with water)	1120 lbs.
Useful load	660 lbs.
Passengers (3)	510 lbs.
Gasoline and oil	150 lbs.
Motor	OX-5 90 hp.
Endurance (full throttle)	2½ hrs.
High speed	85 miles per hour
Low speed	31 miles per hour
Climb (at sea level)	370 ft. per min.
Absolute coiling	10100 ft.
Pounds per square foot	7.9
Pounds per horse-power	19.8



(Ready for Flight)

The **New Longren**

—is scientifically designed for the individual owner. With its side by side seat for two, its pleasing appearance, its super-efficient performance, low operating cost and folding wings for housing, it is the *extremely practical utility* airplane for which you have been waiting.

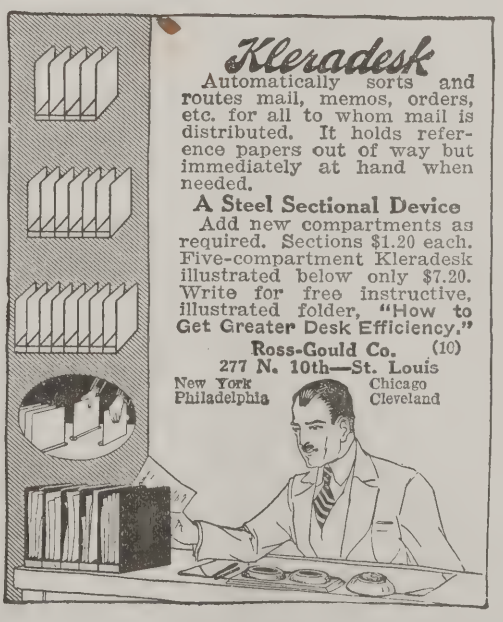
State Distributor's Territories Available
For Further Information Write

The Longren Aircraft Corp.
Dept. 101
Topeka, Kansas

MIDWINTER CLEARANCE
$12 Buys Choice of [Canuck Blueprint included Gratis]

1. 8 New Valves (choice) and 8 Inlet Gaskets.
2. New Zenith OX5 or OXX Carburetor.
3. OX or OXX Cylinder (some new, others used 10 hours).
4. Set of Special OX or OXX Piston Rings and 4 New Valves.
5. 18 Yards Irish (R.A.F.) Linen.
6. New Covered Aileron, Rudder or Elevator (crating $2 extra).
7. New Oil Gauge and Air Speed Indicator.
8. 3 New OX5 or OXX Pistons.
9. Tycos Altimeter or Navy Tachometer with Shaft.
10. New OX or OXX Valve Action.
11. Used A-1 Radiator (crating $2 extra).
12. Set Canuck l.g. Vees, Rear Fuselage Fittings, Tires and Axle.
13. Set JN4D l.g. Fittings, Peach Baskets and Axle.

Delivery at once. 50% must accompany order. Good till March 1 only.
DE LUXE AIR SERVICE **Asbury Park, N. J.**



Kleradesk
Automatically sorts and routes mail, memos, orders, etc. for all to whom mail is distributed. It holds reference papers out of way but immediately at hand when needed.

A Steel Sectional Device
Add new compartments as required. Sections $1.20 each. Five-compartment Kleradesk illustrated below only $7.20. Write for free instructive, illustrated folder, "How to Get Greater Desk Efficiency."

Ross-Gould Co. (10)
277 N. 10th—St. Louis
New York Chicago
Philadelphia Cleveland

Evidence

THE fact that Aerial Age Weekly has by far the largest circulation of any aeronautic periodical in the United States is evidence of the fact that it carries the news while it is news and deals authoritatively with the many phases of world aeronautic progress.

It digests every aeronautic magazine in the world for the benefit of its American readers, and takes the story of American progress to the far corners of the globe.

Aeronautic events of great importance are pending and everyone who would be completely informed on the successive steps in the progress of these events should instruct us to place their names on our subscription list for the next year.

Simply sign the form below and we will do the rest.

AERIAL AGE WEEKLY,
280 Madison Ave., New York.

Please enter my name on your subscription list for one year and bill me four dollars (foreign six dollars) when service has been started.

(Signed) .....

Address .....

.....

CONTEST COMMITTEE
OF THE
AERO CLUB OF AMERICA

Request all owners (individuals or companies) of aircraft in the United States to register in order that the Committee may

1. Send, gratis, the Aero Club's Contest Rules for 1922, and notices of proposed aviation meets.
2. Assist local Clubs in organizing contests best adapted to the types of airplanes in their locality.
3. Have a record of airplanes and pilots available throughout the country in times of emergency.

—Use This Form—

Date.....

Contest Committee, Aero Club of America,
11 East 38th Street, New York City.

I / We { have..... (Give number) } { Airplanes / Seaplanes / Flying Boats / Dirigibles / Free Balloons } Make and Model.....

Motor, Make and Model.....

Maximum speed of.....m.p.h.

Capable of continuous flights of.....miles.

Cubic capacity of gas bag.....cu. ft.

Underwriters Laboratories Aircraft Registration No.....

Pilot's name .....

Address .....

Owner's name .....

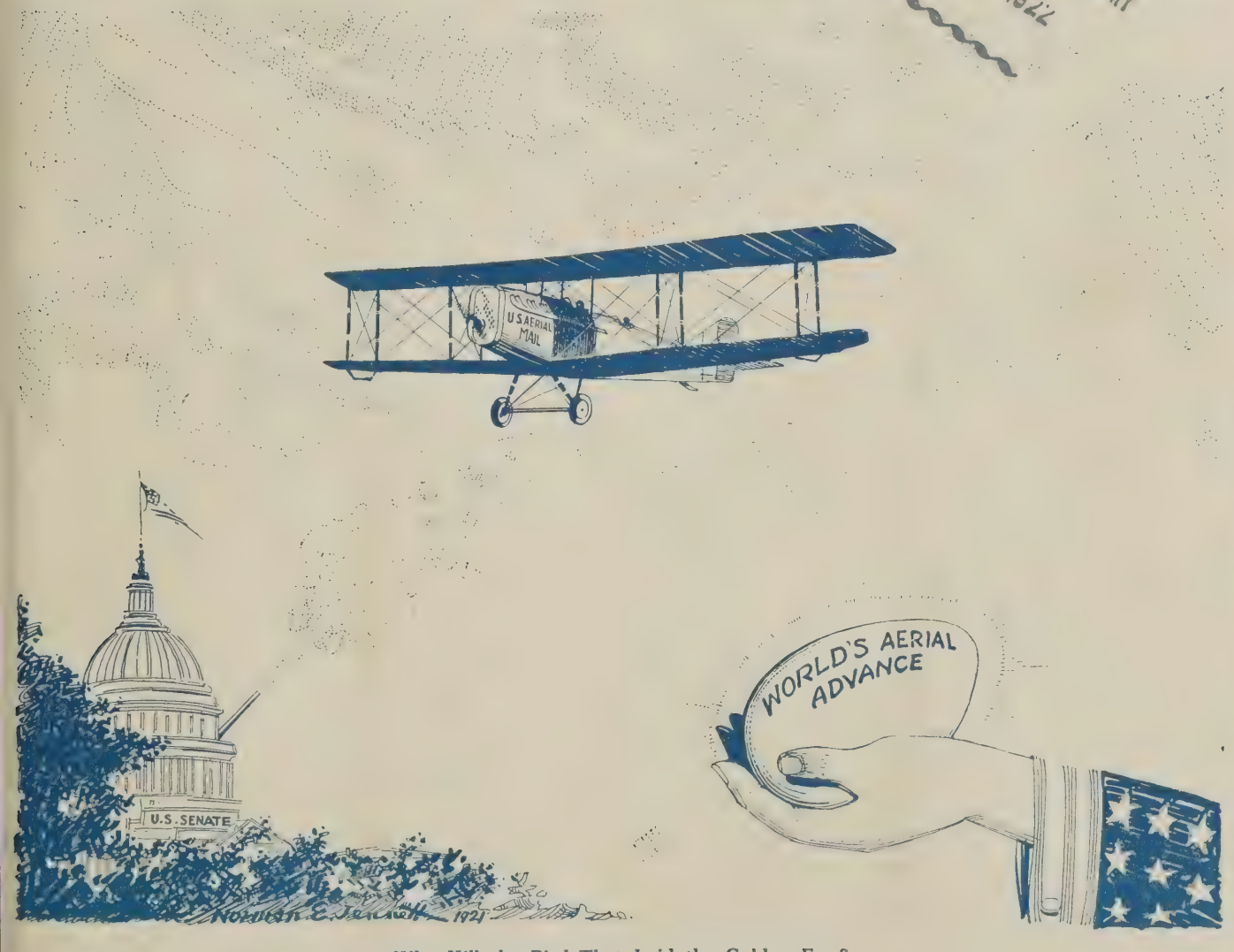
Address .....

AA

AERIAL AGE WEEKLY

VOL. 14. No. 23 FEBRUARY 13, 1922 10 CENTS A COPY

UNIVERSITY OF ILLINOIS LIBRARY
FEB 16 1922



Why Kill the Bird That Laid the Golden Egg?

Reproduced from Aerial Age, January 31, 1921

Report of the Sub-Committee on the Limitation of Aircraft—Fibre in Aircraft Construction

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
ptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

QUALITY
SNAP RINGS

More Than
a Million a Month



Falls
MOTORS
are *also* equipped with
Quality Snap Rings

THE Piston RING COMPANY
MUSKEGON, MICH.

February 13, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 23

TABLE OF CONTENTS

Fibre in Aircraft Construction..... 535
The News of the Week 536
United States Post Office Department Air Mail Service 536
The Aircraft Trade Review 537
Wright Aeronautical Engines..... 537
The Aerial Mail Service..... 538
Effect of Aerofoil Aspect Ratio on the Slope of the Lift Curve..... 540
Department of Justice versus Wright-Martin Aircraft Corporation..... 541
Report of the Sub-Committee on the Limitation of Aircraft 542
The Construction and Testing of Model Aeroplanes 545
Naval and Military Aeronautics.... 547
Foreign News 548
Elementary Aeronautics and Model Notes 549
Aeronitis 550

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.
Printed in U. S. A.

The Farman

"THE MARVEL OF THE AIR"

At New York, Kansas City, Philadelphia, Baltimore, Omaha, Washington — at Paris and Brussels, in Australia and Brazil, the little Farman two-seater has been received with universal admiration, and amazement at its wonderful flying qualities.

Don't rely solely on our claims as to what it will do—just ask the man who's seen it fly or write for copies of accounts of its performances written by unbiased witnesses. They all agree, there's no other airplane like it.

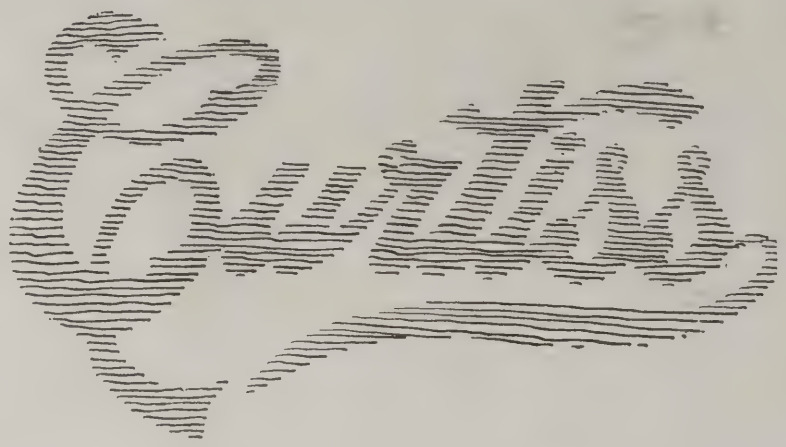
For those who wish *Performance, Quality, Economy, Safety,* to a superlative degree — the best the market affords—there is only one choice—the FARMAN.

The remarkable flying records of these little Farmans are only typical of *every* Farman from the smallest of the family to the giant Goliaths, which are now commencing their *fourth* year of regular service between Paris-London and Paris-Brussels. Since the inauguration of these services, not one passenger of the thousands carried has been injured or killed. *An unbeatable record.*

TYPES: **Two-seater Touring—Motor, New Anzani—three valve 60 H.P.**
Two-seater Sport —Motor, New LeRhone dual-ignition 60 H.P.
Price: **$4850**

WALLACE KELLETT CO., Inc.

WIDENER BUILDING PHILADELPHIA, PA.



Announcing 1922 Price List

NEW PRODUCTION

	LIST PRICE
ORIOLE:	
With OX5 Motor	**$3000.00** F.O.B. Buffalo, New York
With K-6 Motor (1919)	**4400.00** F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	**4800.00** F.O.B. Buffalo, New York
SEAGULL:	
1919 K-6 Motor, dual stick control	**5200.00** F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	**5600.00** F.O.B. Garden City, L. I.
STANDARD:	
With C-6 or K-6 Motor	**3600.00** F.O.B. Garden City, L. I.
MOTORS:	
C-6 or K-6 (150 H.P.)	**3000.00** F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

JN's:	
JN4D with new OX5 Motor	**$2400.00** F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	**$1200.00 to 2200.00** F.O.B. Dallas, Texas
STANDARDS:	
With new OX5 Motor	**2000.00** F.O.B. Houston, Texas
With overhauled OX5 Motor	**1700.00** F.O.B. Houston, Texas
Without motor, rebuilt for OX5	**1100.00** F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	**1600.00** F.O.B. Garden City, L. I.
Without motor, as received from Government	**800.00** F.O.B. Houston, Texas
MOTORS:	
OX5 New	**800.00** F.O.B. Various concentration fields
OX5 Overhauled	**600.00** F.O.B. Various concentration fields
OX5 As received from Government	**500.00** F.O.B. Various concentration fields

NOTE: Where delivery is made from other than F.O.B. points, accrued transportation charges must be added.

WRITE FOR DETAILS IF INTERESTED IN BECOMING A DISTRIBUTOR OR DEALER, STATING TERRITORY DESIRED.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., February 13, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, FEBRUARY 13, 1922 No. 23

FIBRE IN AIRCRAFT CONSTRUCTION

HARD vulcanized fibre seems to be an excellent material for aircraft use. As an aid to comparison, some of the characteristics of fibre will be of interest.

Vulcanized fibre, having a specific gravity of 1.380, weighs .875 pounds per square foot of one-eighth inch thickness, or approximately one pound per twenty cubic inches. Its hardness proves to be around thirty-five in a sclerometer test. Vulcanized fibre has a shearing strength of 13,000 lbs. per square inch, a crushing strength of 43,000 lbs. per square inch and its tensile strength is 13,000 lbs. per square inch.

With these qualities, fibre won't fracture unless it is constantly overloaded and no ordinary force will crush it. It can be machined with ease and can be punched, bent, tapped, turned or threaded. Oils have no effect whatsoever upon fibre and are not absorbed to any appreciable degree. Salts are also without effect, but most mineral acids will in time cause disintegration. Fibre absorbs water to a more or less degree, but is not injured by it. Upon drying, it resumes its original shape. Due to the excellent surface of vulcanized fibre, it can very readily be covered with paint, varnish, enamel or any surfacing material. When used in exposed places, fibre gives very satisfactory service when coated with varnish, shellac or other moisture-resisting compounds. Fibre is an excellent insulator.

Several uses for vulcanized fibre in aircraft construction occur to the writer, one of which has been put into very practical use by the Longren Aircraft Corporation of Topeka, Kansas. This concern has been experimenting since 1916 with fuselages made up of vulcanized fibre and has recently brought out a small two-seater biplane built around this type of fuselage. The fuselage of this plane is built in two halves. These halves are steamed and bent around a form to give it the required shape, then fastened in this position and allowed to dry. The two halves when formed are joined together by two longerons running fore and aft and fastening the two halves at the top and bottom. A few ash formers are inserted inside the fuselage to aid the fibre in holding its shape. This construction assures the Longren of a strong, durable and good-looking fuselage.

Thin weight fibre might very well take the place of plywood in the manufacture of fuselages of monocoque construction. In this case, a form would be made as in standard plywood construction and the thin weight fibre sheet would then be steamed to soften it and carefully wrapped around the form. Additional layers can be wrapped around the first layer and securely glued in place, the whole making a very strong, rigid and durable structure. Fibre for this use may be obtained in any width up to forty-six inches and any practical length.

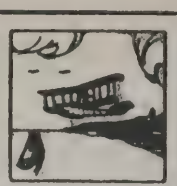
Vulcanized fibre may be obtained in a variety of different colors and it may be said to be practically without a grain and shows no tendency to split under stresses in any direction. Fuselages made of this material for use in combat machines would seem to be specially desirable due to the homogenity of the material. Bullet holes would not appreciably weaken the structure and the holes would not have any tendency to split or spread whatsoever. Vulcanized fibre has a combustion point of 650 degrees and when covered with a fireproof dope would go a long way toward eliminating the fire hazard.

Wire control guides made of fibre are excellent for the purpose and eliminate the chafing and wearing of the wire.

In conclusion, it may be said that vulcanized fibre, due to its strength, light weight, durability and adaptability, should prove of interest to aircraft designers, and experimentation in its use should bring results well worth the expenditure of time.



THE NEWS OF THE WEEK



The Late Colonel Shaughnessy

Washington — Colonel Edward H. Shaughnessy, Second Assistant Postmaster General, died at Walter Reed Hospital February 2, as the result of injuries received in the Knickerbocker Theatre disaster.

Internal injuries caused the death of Colonel Shaughnessy. His wife and 10-year-old daughter, both of whom were seriously injured, are still in the hospital.

A message received today from former Postmaster General Hays, who is at Miami, Fla., said, in part:

"Colonel Shaughnessy's death is a terrible loss.

"I have never known a finer man. No one could have been more efficient or more honest in his service."

President Harding issued this statement:

"I was very greatly grieved to learn of the death of Assistant Postmaster General Shaughnessy. The department officials held him in exceedingly high esteem and counted him a most valuable Government servant. Of course, I have shared the views of those who worked in intimate association with him."

Colonel Shaughnessy, who was 39 years old, began his active life as a telegrapher on the Chicago & Northwestern Railroad, rising to be trainmaster at Chicago in 1917, when he entered the military service as First Lieutenant in the Thirteenth Regiment of Railway Engineers. He served as superintendent of transportation at Château-Thierry, and later was general superintendent of transportation during the St. Mihiel drive. Next he became general manager of transportation in the zone of advance during the Argonne offensive, having been promoted to the rank of Colonel. For his service he received a decoration from France and the Distinguished Service Medal from the American Government.

Landing Field on Governors Island

The Aero Club of America has recently been negotiating with the War Department for the re-establishment of a landing field on Governors Island, New York, and have just received the following letter, signed by Major General Mason M. Patrick, Chief of the Air Service:

"I am in receipt of your letter of January 21st with reference to the clearing of land on Governors Island, and wish to advise you that I have already taken up the matter of the establishment of a landing field there with the Commanding General of the 2nd Corps Area.

"The Adjutant General of the Army has forwarded a decision to the 1st Corps Area, with reference to the establishment of a landing field at Boston, in which the existing law is interpreted as authorizing the War Department to lease airdromes for the establishment of National Guard and Reserve squadrons, with the Reservation by the lesser that other governmental agencies, commercial firms and individuals may install hangars and conduct their operations from the field, with the approval and under such rules and regulations as may be prescribed from time to time by the Secretary of War. This is a great aid to us in the building up of proper facilities for the training of our National Guard and Reserve Squadrons."

Speed of 312 Miles an Hour Claimed for a Helicopter

London—An air journey from New York may be made in a single day, according to the remarkable claim made on behalf of the Hansch Helicopter, news of which has been received by the Air Ministry through unofficial channels.

The machine is the invention of a Dutchman. It is said to be capable of attaining a speed of 312 miles an hour, to be able to ascend and descend vertically or to remain stationary in the air over any given spot without the least danger of failing.

The news is the more interesting since the British Air Ministry intended, subject to Treasury sanction, to offer a prize of £50,000 for a practical design of a helicopter.

Belgian Queen to Have Her Own Plane

An especially designed plane left Croydon recently for Brussels to be turned over to the Queen of the Belgians for her own private use. It is the gift of the British Aircraft Disposal Board to the Queen, who has the same enthusiasm for flying as has her husband, King Albert. She says she will fly regularly in the future.

The flying machine is a Bristol model, the same as King Albert has been using, with a Rolls-Falcon engine capable of a speed of 120 miles an hour at an altitude of 5,000 feet. While King Albert's flying machine is finished in dark colors that of the Queen is finished in beautiful silver and the interior decorations are in accordance with her ideas. It's only a two seater, with the result that she will do most of her flying with only a pilot.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, December 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing and Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST: Gallons of Gasoline	Total Time Run	Hr. Min.	Total Miles Run	Cost per Hour	Cost per
EASTERN New York-Chicago.....	$4,112.63	$750.04	a$6,575.52	$3,231.85	$1,451.20	$1,244.53	$3,415.50	$1,684.63	$4,271.68	$3,868.15	$175.39	$2,017.05	$810.83	$33,609.00	12,030	412	40	38,863	$81.47	$(
CENTRAL Chicago-Rock Springs.	4,822.48	1,519.87	b13,579.83	2,610.43	1,837.35	1,035.72	3,757.39	2,439.80	6,093.64	5,637.34	254.00	2,921.25	1,174.30	47,683.40	17,131	668	08	63,763	71.38	
WESTERN Rock Springs San Francisco	3,181.83	447.73	c11,357.82	2,026.45	1,762.14	640.67	3,366.94	1,684.63	4,301.31	5,199.52	175.39	2,017.05	810.82	36,972.30	10,415	451	38	38,630	81.89	
TOTALS and Averages.....	$12,116.94	$2,717.64	$31,513.17	$7,868.73	$5,050.69	$2,920.92	$10,539.83	$5,909.06	$14,666.63	$14,705.01	$604.78	$6,955.35	$2,795.95	$118,264.70	39,576	1,532	26	141,256	$76.17	$(

a Includes new motor in plane No. 286.
b Includes new motors in planes No. 177, 210 and 216; also new wings on plane No. 127.
c Includes new motors in planes No. 126 and 167.

Total operating cost	$118,264.70
Permanent improvements	3,719.74
Loss on unrepairable crashes	14,000.00
Fives planes burned in hangar fire (Maywood, Ill., Dec. 25th)	50,000.00
GRAND TOTAL	$185,984.44

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern	$0.23	$0.24	$0.39
Central	.17	.20	.38
Western	.23	.21	.52
Entire Service	$0.20	$0.21	$0.42

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycle and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio; Testing an Experimental Work.
Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessorie Warehouse.
Flying consists of: Gas; Grease and Oil; Pilots.

E. H. SHAUGHNESSY, Second Assistant Postmaster General

The AIRCRAFT TRADE REVIEW

New Aeroplane Compass

A satisfactory type of aeroplane compass has been invented by Doctors Paul R. Heyl and Lyman J. Briggs of the Bureau of Standards, of the Department of Commerce. Flying tests with this instrument have been made, and the air service is now engaged in putting a number of models into service.

The instrument weighs only 13 pounds, while the weight limit set by the air service was 25 pounds.

The new compass depends for its action not on a magnetic needle, but upon a revolving coiled wire. This principle is by no means new, but it has remained for the Bureau of Standards to apply it in such a way as to make the device practically operative under the very severe conditions prevailing in actual flight or aeroplane stunts.

The problem of perfecting a satisfactory aircraft compass was given the Bureau of Standards about a year ago. At the end of the war no completely satisfactory compass had been devised. Its importance to aviation is apparent when it is remembered that no aeroplane compass heretofore perfected has been able to keep up with the evolutions of a plane. Whenever the plane turned rapidly, or was stunted, compasses were not reliable. The result was that many pilots lost their lives by losing all idea of direction. Several of the air mail pilots have been killed because of the lack of a satisfactory compass. One of them crashed at full speed into a mountain in Pennsylvania.

Personal Par

Friends of B. H. Pearson will be glad to know that he has added one more to his already extended list of experiences by being a member of an expedition to the South Sea Isles on a treasure hunt, in which he had several diving suit thrills amidst numerous sharks. He is persuaded that the diver's luck is even more thrilling than the aviator's.

Applications of Modern Hydrodynamics to Aeronautics

This report, by L. Prandtl gives rather briefly in Part I an introduction to hydrodynamics which is designed to give those who have not yet been actively concerned with this science such a grasp of the theoretical underlying principles that they can follow the subsequent developments. In Part II there follows a separate discussion of the different questions to be considered, in which the theory of aerofoils claims the greatest portion of the space. The last part is devoted to the application of the aerofoil theory to screw propellers.

A copy of Report No. 116 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Schutte-Lanz Expert Arrives

Negotiations for the establishment of airship lines across this continent are believed to be the cause which has brought Walter Bleistein, Director and Chief Engineer of the Schutte-Lanz Airship Co. of Germany to Washington. Dr. Bleistein, who is both an airship pilot and engineer, would neither confirm nor deny these reports, but agreed to the possibility of such lines in this country and evinced considerable enthusiasm over the future of the rigid airship as a commercial carrier. He believes that airships for transportation would supplement the present methods of long distance routes without competing with them.

Believing in both the safety and economy of airship, Dr. Bleistein stated that not a passenger had been hurt and no trouble experienced in several years of transportation in Germany. With the most advanced designs and specifications for passenger and freight ships, Dr. Bleistein hopes to interest American commercial operators, it is believed.

In this climate he believes almost perfect operation could be maintained and perishable freight rushed across the continent in the excellent time of 36 hr. As a valuable means for shippers, he indicated that it seemed possible to keep up a schedule of 10 hr. from New York to Chicago; 36 hr., New York to San Francisco; 55 hr., New York to Europe; and 24 hr. San Francisco to Honolulu; while toward the southern continent he estimated that goods could be delivered at Santiago, Chili, or Buenos Aires in 90 hours.

WRIGHT AERONAUTICAL ENGINES

By C. G. PETERSON

It is noted in your issue of December 19th, giving the performance tests of a Spad equipped with a 220 h.p. Hispano-Suiza engine, mention was made in the article that the Wright Aeronautical Corporation was the builder of this engine. This is incorrect as that company has never built any 220 h.p. geared engines and this engine consequently must have been a French built Hispano. It is therefore technically incorrect to call it a "Wright engine." This very slight error in phraseology of course is easily accounted for, inasmuch as even though the engines built by the Wright Aeronautical Corporation are officially known as "Wright engines," yet, the favorite nickname of "Hiso" will come first to the lips of most pilots. But this confusion of the French built Hiso's with the present Wright engines may give an incorrect impression of the present Wright engines.

The Wright Aeronautical Corporation has completed an order for Wright E-2 engines. This production order was finished on time and in an extremely satisfactory manner, as shown by dynamometer tests and the flying performances of a large number of these Model E-2 engines. The guaranteed power was 190 h.p. at 1800 r.p.m. The average actual power shown on 37 Wright E-2 engines, tested during the hottest part of last summer, during July and August, was 201.4 h.p., bettering the guarantee by the safe margin of 6%. The guaranteed fuel consumption was 52 lbs. per h.p.hr., whereas the average actual test consumption was only .48 of a pound per h.p. hr. This is a material saving in operation as it represents a decrease of 1 1/3 gallons of fuel per hour at 200 h.p. The oil consumption, as shown by these average tests, was only 2½ pints per hour, less than half the guaranteed amount. Of course the saving of this amount of oil under the guarantee represents an even larger monetary saving than the 1 1/3 gallons of gas.

Earlier issues of "Aerial Age" have described in detail the changes of the Wright E-2 engine from previous models. One of the most important changes was thickening the steel cylinder head to obviate valve trouble. The flying tests of this Wright E-2 engine have clearly demonstrated the benefit of this change inasmuch as it is very apparent that the necessity for frequent regrinding of valves has been eliminated. Actual flying records on these Wright E-2 engines show that considerably more than 75% of those that have been flying steadily for some months have never had their valves ground and no replacements or adjustments made. Some have flown considerably over 100 hours. It is believed that in average service it will not be necessary to touch up the valves under 200 hours.

In addition to the above service reports, an actual flying test on this Wright E-2 engine was made in an Aeromarine-40 flying boat. The engine was tested for power before and after being installed in the boat. The time in the air was 100 hours with 26 hours additional running on the ground and 63 hours on the dynamometer, a total of 189 hours running. When tested on the dynamometer, after running 189 hours, the engine pulled 200 h.p. at 1800 r.p.m. and was in perfect condition.

Provisions are being made for bringing out, this Spring, a new model of this same cylinder size which will be called the Wright E-3 Alert. The preliminary tests being made to prove the efficacy of some of the proposed changes give promise of excellent results in the new model. The power will be increased, the weight decreased and the fuel consumption be made even more economical. The exceedingly large experience the builders of these engines have had in contracts with the American and foreign Governments make it certain that the new Wright E-3 Alert engine will not only accomplish what is predicted for it but will maintain its high position in the class of aviation engines of this displacement.

THE AERIAL MAIL SERVICE

Address by Colonel E. H. Shaughnessy, Second Assistant Postmaster-General, to Washington Section, Society of Automotive Engineers

THE Post Office Department since its beginning in 1789, may, in my opinion, be justly called the foster mother of safe, rapid and regular transportation, not only within the boundaries of our own country, but between this country and our neighbors near at hand, and those overseas.

From the very first, one of the finest traditions in the Post Office Department has been the continual, persistent effort on the part of its executives to develop, by every possible means, frequent and expeditious handling of the United States Mail. The cumulative result of this policy is well reflected in the commercial and social life of the nation today which has at its beck and call every hour of the day in the Post Office Department the greatest organization in the world, measured from a purely service standpoint.

This work of encouraging good transportation started away back in the stage coach days, when four-in-hand mail coaches, dashing along the highways, were the pride of the countryside. Then, when the first straggling railways were put into operation, the Post Office Department, true to its tradition with respect to transportation, immediately turned to them as the next logical step in the direction of an efficient mail service. It took courage to do this, because there was a selection of public opinion, majority opinion in fact that condemned the newfangled, weird looking railway equipment of that day as not only useless but actually dangerous and not to be tolerated in a well regulated community.

To my mind, it seems but fair to say that the Post Office Department, through its liberal patronage to the railways, from the first down to the present time, has contributed, more perhaps than any other single agency, to the wonderful development that has taken place in this land of ours with respect to fast and frequent passenger train service. The growth of the railway mail service since its inception is worthy of an epic in itself.

The same story can be repeated in so far as ocean transportation is concerned. The Post Office Department has kept the American flag on the high seas when all else failed and today is lending most effective support to the splendid work that is being done to re-establish a real American mercantile marine.

I might say in passing that the privilege of carrying the mail has always been eagerly sought after and charily granted, because the legend "United States Mails," carried at the masthead of a ship or on the side of a train or vehicle is a mark of distinction, in fact a certification that the mail carrier is to be trusted in every respect.

My purpose in being here tonight, however, is not to deal in generalities concerning transportation. I am here to give this section of the Society of Automotive Engineers specific information regarding the latest venture of the Post Office Department into the transportation field, namely, the Air Mail Service. I asure you that it is a pleasure to do this. We welcome in the fullest sense your consideration of this newest phase of the transportation problem. There is, without question, great need for intelligent study along this line; particularly is there need for wise counsel, not only with reference to the Air Mail Service per se but aviation generally speaking.

In describing the Air Mail Service, please understand that I am speaking from a transportation standpoint, not from a technical standpoint and intend to simply state the facts as they exist letting you draw your own conclusions therefrom.

The Air Mail Service operated by the Post Office Department was started May 15, 1918, the first step being the establishment of a mail route extending from Washington, D. C., to New York City via Philadelphia, no intermediate stops being made. To begin with army planes and army personnel were used. The planes were the JN4-H type, equipped with 150 H.P., Hispano-Suiza motors having a carrying capacity of 150 pounds of letter mail, or approximately 6000 letters.

On August 12, 1918, the Post Office Department, having perfected civilian organization, relieved the Army from further duty with the air mail service, thereupon assuming full charge of all activities and at the same time putting in use the standard E-4 type plane, equipped with the same 150 H.P., Hispano-Suiza motor but having a carrying capacity of 200 pounds, or approximately 8000 letters.

The Washington-New York route operated steadily and successfully, warranting further expansion, and on May 15, 1919, or one year later, the first leg of the transcontinental route was established from Cleveland to Chicago, via Bryan, Ohio, using the De Haviland 4 type plane, equipped with the 400 H.P., Liberty motor, having carrying capacity of 350 pounds, or approximately 14,000 letters.

Further extension followed rapidly. July 1, 1919, service was started from Cleveland to New York City, via Bellefonte, Pa., May 15, 1920, from Chicago to Omaha, via Iowa City, Iowa. September 6, 1920, from Omaha to San Francisco, via North Platte, Nebr., Cheyenne, Wyo., Salt Lake City, Utah, and Reno, Nevada. In addition to the transcontinental trunk route, additional lateral routes were put into operation as follows: August 16, 1920, from St. Louis to Chicago and on December 1, 1920, from Chicago to Minneapolis.

That was the situation when the present administration took office; that is to say, there were in operation air mail routes from New York City to San Francisco, St. Louis to Chicago and Minneapolis to Chicago over which mail planes were flying regularly during the daylight hours.

Great things had been acomplished in the way of extending the air mail service, but the situation as we found it was not altogether satisfactory. Criticism was being directed toward the service by the public and the Congress, principally due to the fact that there had been a series of unfortunate accidents during 1920, which had resulted in considerable loss of life. In addition to this feature, Members of Congress in Committee and on the floor objected to the manner in which the air mail service had been extended and financed.

To explain this latter point, let me say that Congress alone has the right to designate postal routes and so far Congress has specifically authorized and appropriated for but one air postal route, namely, New York City to San Francisco. However, in passing legislation to assist the Post Office Department in developing air mail service, Congress authorized the War Department to turn over to the Post Office Department surplus aviation equipment and authorized the Postmaster-General to pay for the operation of same out of the money appropriated for the transportation of mail by railways.

Under this last provision the air mail service had been rapidly extended during the latter part of 1920, the expenditures in connection with such extension being charged, for the most part, to the appropriation for railway compensation which resulted in an embarrassing predicament, putting the incoming administration in the position of being all dressed up and no place to go; because the Comptroller-General ruled that while it was perfectly legal to use the railway funds to operate surplus War Department airplanes, planes so operated could not be used on the New York-San Francisco route for which Congress had specifically appropriated $1,125,000; on the other hand Congress had not authorized any air route other than the New York-San Francisco one.

The whole matter was given very serious consideration. A careful check up indicated that most of the operating difficulties came from too rapid expansion without providing necessary facilities with which to operate efficiently. Then there was the necessity for getting four square with the Committees in Congress, so we decided to start a new deal all around; first, to carry out the intent of Congress, which let me say is not unfriendly to an air mail service, simply and very properly unfriendly to what Congress thinks is maladministration in any service; second, to align ourselves with the expressed desire of the Administration for economy, and third, to put into effect my own thought that we would be helping aviation in a much more beneficial way if we stopped the too rapid expansion, which through lack of sufficient facilities seemed to be making the air mail service an extra hazardous occupation and instead consecrate our efforts on standardizing and perfecting the operation on a more restricted route.

For these reasons we decided to discontinue the laterals. Washington to New York City was abandoned May 31, 1921, St. Louis-Chicago and Minneapolis-Chicago June 30, 1921, which reduced our expenditures at the rate of $675,000 per annum. Today we are only operating the New York City to San Francisco route. It may be interesting to know that while we have materially reduced the mileage in taking off these laterals, our mailplanes are going to fly for the fiscal year July 1, 1921 to June 30, 1922 at least 1,800,000 miles as compared with 1,760,000 for the preceding fiscal year, this showing being due to increased efficiency in flying performance.

From now on I am going to give you briefly figures and statements to show what the service consists of. Before doing so let me explain that the air mail service as at present operated is used as an auxiliary to the fast mail train service because

we do not attempt to fly at night. We hope that within a reasonable length of time, the proposed Bureau of Aeronautics in the Department of Commerce, will come into being and start the work of marking the airways for night flying. When this is done the real value of an air mail service will be at once apparent, for with night flying mail can be put across the continent in less than thirty hours. As a matter of fact on a test flight on February 22,1921, the air mail put mail across from San Francisco to New York in 25 hours and 21 minutes actual flying time. This was a notable performance but altogether too hazardous to try again until the way is marked by suitable aids to flying such as light houses, beacons, etc.

General

The length of transcontinental route is..	2,680 miles
Number of miles flown daily with mail..	5,360
Number of ships in air daily.....	21
Average mileage for each ship in air....	255
Number of pilots in service.....	43
Number of other employees.....	436
Total annual salaries all employees.....	$787,620
Number of fields equipped with suitable hangars	15

The Transcontinental Route is divided into three operating Divisions. The Eastern Division from New York to Chicago is 770 miles long, with headquarters at New York; the Central Division from Chicago to Rock Springs, Wyo., 1,125, with headquarters at Omaha, and the Western Division from Rock Springs, Wyo., to San Francisco, 785, with headquarters at San Francisco.

Fields

Air Mail Fields are located at the following points:
Hempstead, Long Island, N. Y.
Bellefonte, Pa.
Cleveland, Ohio
Bryan, Ohio
Chicago, Ill. (Checkerboard Field, Maywood, Ill.)
Iowa City, Iowa
Omaha, Nebr.
North Platte, Nebr.
Cheyenne, Wyo.
Rawlins, Wyo.
Rock Springs, Wyo.
Salt Lake City, Utah
Elko, Nevada
Reno, Nevada
San Francisco, Calif.

In addition to these fields there is an Air Mail Warehouse at Newark, N. J., and an Air Mail Depot, Maywood, Ill.

Radio Stations

Radio stations are located at headquarters (Washington, D. C.) and at all fields except Rawlins, Wyo. Navy Radio stations are used jointly at Cleveland, Ohio, Chicago, Ill., and San Francisco, Calif. All the other radio stations are owned and operated by the Post Office Department.

Employees

	No. Employees	Total Salaries
Headquarters	32	$63,070
Warehouse, Newark, N. J.....	39	52,550
Repair Depot, Maywood, Ill.....	88	131,350
Eastern Division	126	214,100
Central Division	103	172,850
Western Division	91	155,700
	479	$787,620

Equipment

During the period from May 15, 1918, to October 31, 1921, (3 years and 5½ months) 221 planes have been used in the Air Mail Service.

Following tabulation shows what has become of them:

Crashed and parts salvaged.....	81
Crashed and burned—no salvage.....	20
Burned on ground—no salvage.....	7
Withdrawn—unsatisfactory type—parts salvaged	19
Withdrawn on account of age—parts salvaged.....	8
Withdrawn and stored—small type.....	9
Transferred to Army	1
Available October 31—flying condition.....	50
Available October 31—undergoing repair.....	26
	221

Since last June, when the reorganization of the Air Mail Service took place, great strides have been taken in connection with standardizing and improving the flying equipment. From the first a number of different types of planes had been used, principally JN 4-H Standard E-4, JL's twin motored DH-4 and a single motored DH-4. We have standardized on the single motored DH-4 and have eliminated all other types—this does not mean that the DH-4 is the most suitable plane available, it simply means that it is a satisfactory plane for air mail service and good business to standardize on it, because the Army has a large surplus which is transferred to our service as needed without expense to us. It may be interesting for you to know something in connection with the useful life of the DH-4 based on our experience. I have the record on four planes showing what can be done in this direction.

		First Trip	Miles Flown	Hours	Condition
DH-4	71	March 3, 1919	55,416	625	Good, still in service
"	99	Nov. 15, 1919	64,590	699	" " " "
"	104	Dec. 18, 1919	58,219	634	" " " "
"	175	Oct. 5, 1920	54,079	647	" " " "

We have in the Air Mail Service at the present time 143 planes, 50 in serviceable condition, 38 being overhauled and 55 in storage awaiting overhauling.

Another item that may be interesting is that during the fiscal year ending June 30th, 1921, the Post Office Department paid companies for rebuilding and converting planes the sum of $276,109, and purchased eight planes for $200,000, a total of $476,109, while since July 1st, this year, no planes have been purchased and all conversion work has been done by our own repair shop at an average cost of $1,200, and at the same time our situation has materially improved. We have today 14 more planes in serviceable condition than on July 1st last.

Organization

The Air Mail Service is directed by a General Superintendent located in Washington, reporting to the Second Assistant Postmaster-General. The field service is divided into three operating divisions under the supervision of division superintendents located at Hempstead, L. I., Omaha, Nebr., and San Francisco, Calif. Each superintendent has an assistant superintendent to assist in general supervision, and local field managers at each landing field. In addition to this there is a supply warehouse at Newark, N. J., and a repair depot at Maywood, Ill., in charge of superintendents, reporting directly to headquarters as I have stated before. The total number of employees is 479, annual payroll, $787,620. Prior to the reorganization July 1st last, the payroll carried 521 employees, salaries, $864,321.

Performance

The operating performance of the Air Mail Service in recent months has been truly remarkable. For the first quarter of the current fiscal year, that is, from July 1st to September 30th, 1921, 98 per cent. of all scheduled trips were completed. By divisions, the record is as follows:

Division	Miles Flown	Letters Carried	Per Cent.
New York—Chicago	112,626	3,506,000	98.5
Chicago—Rock Springs	168,805	4,310,760	97.6
Rock Springs—San Francisco	109,587	2,197,520	98.

In compiling these figures, trips are not counted unless completed.

In addition to the 391,018 miles flown with mail on regular schedule, our records show 49,662 miles of test flights and ferry trips, making a grand total of 440,680 miles flown in the three months.

An exceptionally good record was made on that portion of the route between Cleveland, Ohio, and Chicago, Ill., air distance 335 miles. No mail trips were defaulted from April 29th to October 31st, a period of 185 days. During that period, 98,890 miles were flown and 3,271,360 letters carried. Our records show that approximately two-thirds of all mail trips are made in clear weather, the balance in fog, rain or snow.

During this same quarter there were eleven (11) crashes, eight of which occurred on Air Mail fields and three at outside points of forced landings. Two ships were entirely destroyed, but during the quarter there were no fatalities or injuries to employees on regular mail trips. There was, however, one fatality on a ferry trip. On July 16th, 1921, Pilot Howard Smith lost his life in Ship No. 222 on the San Francisco field. He was assigned to ferry his ship to Reno, and fell from an altitude of 300 feet when taking off.

Casualties

During the period May 15, 1918, to November 30, 1921, three years, six and one-half months, there have been thirty

fatal accidents in the Air Mail Service, by fiscal years, that is to say from July 1st to June 30th, as follows:

	Pilots	Mechanics	Other Employees
1917 (1½ months)	0	0	0
1918 (12 months)	2	1	0
1919 (12 months)	6	1	2
1920 (12 months)	13	4	0
1921 (5 months)	1	0	0
	22	6	2

During 1920, using round figures, there was one fatality for each 100,000 miles flown. Since July 1st we have had one fatality for 800,000 miles flown.

In my opinion, this very much improved showing comes principally from putting into effect a sensible, businesslike program, using trustworthy men and material, leaving the experimenting and stunting to those who are not entrusted with the United States mails. I want to emphasize the fact that since July 1st last, during which time this remarkably fine record has been made by our pilots, DH-4 planes have been used exclusively. I cannot say too much at this time in commendation of our Air Mail pilots, several of whom have flown 100,000 miles carrying mail. Since the beginning of the service, Air Mail pilots have flown 3,400,000 miles carrying more than 2,500,000 pounds of mail, or approximately 100,000,000 letters. No finer class of men or pilots can be found anywhere, individually or collectively, than those in the Air Mail Service. It is a pleasure to recognize publicly the work they are doing. They are worthily carrying on the best traditions of Postal Service.

Cost of Operation

Statistics have been published regularly showing operation and maintenance costs of the Air Mail Service which are useful for comparative purposes but have not been truly representative, in my opinion, because the figures shown have not included such items as general overhead expense, permanent improvements, surplus supplies on hand were not charged out until used, planes purchased were not charged to capital account, etc. Using the statistics as they have been published, the purely operating and maintenance cost per mile during the quarter ending September 30, 1920, was 87 cents; for the same quarter 1921, 71⅓ cents, a reduction of 15⅔ cents per mile. Without much further delay, we intend to revise the cost sheet so as to include every dollar properly chargeable to the Air Mail Service. The new method applied to the periods just given you would result in a cost per mile of $1.43 for 1920 and $1.04 for 1921, or a reduction of 39 cents per mile operated.

This material reduction in operating cost is chargeable principally to reduced overhead expense, secondly to increased efficiency from the personnel, jobs are thought more of nowadays than for several years past, and thirdly, to economy in purchasing supplies, principally gasoline. We are successfully operating today on domestic aviation gas whereas formerly the so-called fighting grade was used. Cost per mile means nothing unless translated into ton mile figures. Taking the last figures quoted you, which are truly representative, we found that last year the DH-4 plane, carrying 350 pounds of mail, was operated at the rate of $8.00 per ton mile. This year the same plane, carrying the same load, costs at the rate of $6.00 per ton mile; however, we have recently put into service an improved DH-4 with the load carrying capacity increased to 800 pounds, an increase of over 100 per cent. in utility with no additional operating cost, in fact identically the same plane merely redesigned, which will bring the ton mile cost down to $2.60, a remarkable reduction over the figures of a year ago. No doubt private enterprise can do much better than this, because, as you gentlemen well know, the Liberty motor is expensive to operate. Our justification for using them is that they are surplus stock in the War Department and cost us nothing.

Policy

In conclusion, just a word as to the future policy of the Post Office Department with reference to Air Mail Service. The department, true to its tradition, wants air transportation of the mail because in that direction lies rapid transit. Whether it be heavier than air or lighter than air types of carriers is immaterial if the service given is reliable and speedy. The department, however, does not feel that it should operate an Air Mail Service any more than it should operate a steamboat service or a railway service only until such times as the commercial interests of this country are ready to step in and take over the burden.

We are willing and eager to co-operate to the fullest extent in assisting real commercial aviation, not by any possible chance to enter into contracts with companies or individuals in the prospectus, stock selling stage who want to use the legend "United States Mails" to sell stock, but with those having ships in the air ready to load the mails. How soon that time will come, we, of course, do not know, but let us all hope that it will be soon, and collectively do everything we can consistently to advance the date, because, after all, there are other important uses for aeroplanes aside from carrying commerce. This country of ours still needs the sort of protection that aeroplanes and airships and air men can give.

EFFECT OF AEROFOIL ASPECT RATIO ON THE SLOPE OF THE LIFT CURVE

By WALTER S. DIEHL

Introduction

ONE of the most important characteristics of an aerofoil is the rate of change of lift with angle of attack, $\frac{dC_L}{d\alpha}$. This factor determines the effectiveness of a tail plane in securing static longitudinal stability. The following application of the Göttingen formulas in calculating the variation of $\frac{dC_L}{d\alpha}$ with aspect ratio should therefore be of interest to many aeronautical engineers.

Variation of $\frac{dC_L}{d\alpha}$ with Aspect Ratio

The relation between the angles of attack at which a given lift coefficient obtains for two aerofoils of the same section but of different aspect ratio is expressed by the equation:

$$(\alpha_1 - \alpha_2) = \frac{C_L}{\pi}\left(\frac{S_1}{b^2} - \frac{S_2}{b^2}\right) \times 57.3 \ldots\ldots (1)$$

where S is the area, b the span and C_L the absolute lift coefficient defined by $L = C_L \times \frac{1}{2} \rho S V^2$. This formula, due to Dr. Prandtl and Dr. Munk of Göttingen University, has been checked by tests and found reliable. A verification by Dr. Prandtl may be found in "Ergebnisse der Versuchsanstalt zu Göttingen" (1921, p. 51 et seq.)

If the value of $\frac{dC_L}{d\alpha}$ be known for an aerofoil section at a given aspect ratio the value for any other aspect ratio may be calculated from (1) by the method illustrated in Fig. 1. For the average aerofoil $\frac{dC_L}{d\alpha}$ is substantially constant over an angular range of, say 10°, or more, Assuming $\frac{dC_L}{d\alpha}$ to be constant with the value thus defined, the angular range corresponding to an increase in the lift coefficient from zero to any value C_L is

$$\alpha_1 = C_L / \left(\frac{dC_L}{d\alpha}\right)_1 \ldots\ldots (2)$$

For the same section in other aspect ratio, C_L will obtain at the angle α_2 defined by equation (1) or

$$\alpha_2 = \alpha_1 - (\alpha_1 - \alpha_2) \ldots\ldots (3)$$

The value of $\frac{dC_L}{d\alpha}$ corresponding to this aspect ratio is $\left(\frac{dC_L}{d\alpha}\right)_2 = \frac{C_L}{\alpha_2}$ as shown by Fig. 1.

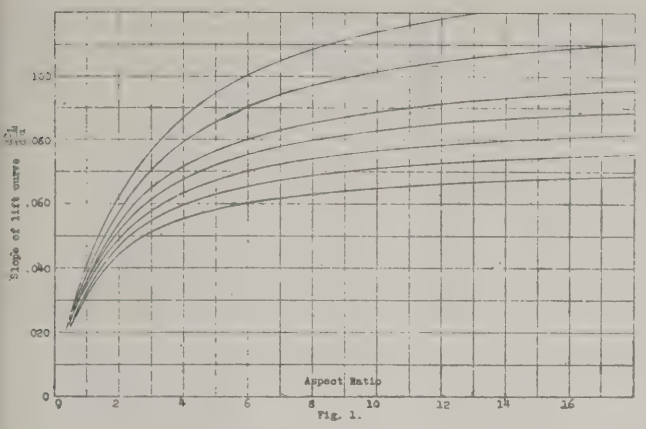


Illustration of Method

Assume that it is desired to find $\frac{dC_L}{d\alpha}$ for an aerofoil of aspect ratio 2.5 when from test data it is known that $\frac{dC_L}{d\alpha} = .072$ for the same section at aspect ratio 6. For convenience, take $\triangle C_L = 0.10$, then

$$\alpha_1 = \frac{\triangle C_L}{\left(\frac{dC_L}{d\alpha}\right)_1} = \frac{0.10}{.072} = 1.390°$$

$$(\alpha_1 - \alpha_2) = \frac{C_L}{\pi}\left[\frac{S_1}{b^2_2} - \frac{S_2}{b_2}\right] \times 57.3$$

$$= \frac{0.10}{\pi}\left[\frac{1}{6} - \frac{1}{2.5}\right] \times 57.3$$

$$= -0.427°$$

$$\alpha_2 = \alpha_1 - (\alpha_1 - \alpha_2)$$

$$= 1.390° + 0.427°$$

$$= 1.817°$$

$$\therefore \left(\frac{dC_L}{d\alpha}\right)_2 = \frac{0.10}{1.817} = .055$$

Application

For the convenience of the engineer a set of curves calculated by this method are given in Fig. 1. Also, the observed value of $\frac{dC_L}{d\alpha}$ for a few standard aerofoils are given in Table 1. It is of interest to note that the observed values of $\frac{dC_L}{d\alpha}$ for the same aerofoil at various aspect ratios follow the calculated curves closely. For application, reference is made to N. A. C. A. Report No. 96, "Statical Longitudinal Stability of Airplanes," in which the effect of $\frac{dC_L}{d\alpha}$ is treated.

Aerofoil Section	Aspect ratio	$\frac{dC_L}{d\alpha}$	Aerofoil Section	Aspect ratio	$\frac{dC_L}{d\alpha}$
USA-15	6	.077	M-80	6	.074
" 16	6	.076	M-6	6	.068
" 27	6	.072	RAF-6 (M.I.T.)	5	.070
USATS-2	6	.070	"	6	.075
" 5	6	.072	"	7	.077
Durand-13	6	.074	"	8	.079
Sloane	6	.075	"	9	.082
RAF-14	6	.078	RAF6a-(NPL)	6	.071
" 15	6	.070	"	13	.078
" 16	6	.074	Göttingen 164	2	.050
" 19	6	.094	"	3	.060
Albatros	6	.076	"	4	.067
Göttingen 173	6	.075	"	5	.072
" 227	5	.074	"	6	.074
" 242	5	.078			
" 255	5	.072			
" 256	5	.070			
" 322	5	.076			
" 344	6	.078			

(Technical Note, National Advisory Committee for Aeronautics.)

DEPARTMENT OF JUSTICE VERSUS WRIGHT-MARTIN AIRCRAFT CORPORATION

In connection with the statement issued from Washington that the Department of Justice is about to bring suit against the Wright-Martin Aircraft Corp. for approximately $4,700,000 for alleged overpayment by the Government on war contracts, an official of that Company has given AERIAL AGE the following statement:

"Since the completion, back in 1919, of Wright-Martin's work for the United States Government in making aeroplane engines, it has been found absolutely impossible for the corporation to collect from the Government the full amount due under its contracts. There is still due the Wright-Martin Corp. in excess of $1,000,000, vouchers therefor having been certified by the government's own accountants, which up to date, by one means or another, the Government has postponed paying to the corporation in accordance with the terms of its contracts. Out of the total business done for the Government, in excess of $35,000,000, the corporation has requested payment of practically no sums which were not properly vouchered and certified as being due to the corporation by the Government's own representatives.

Items in Dispute

"Since the completion of the contracts we have submitted two complete audits of our contracts which were performed at New Brunswick, and which alone are involved in the present discussion. Except for minor errors found by such re-audits, the government auditors were unable to find any evidence that the sums claimed by our corporation had not been expended by this corporation in the performance of its contracts.

"Having failed by these exhaustive methods of audit to establish any reason for paying the corporation less than the sums due it under contract, the government officers last summer began to urge that many of these sums were not, as a matter of contract interpretation, properly chargeable to the Government, although spent for the performance of the contracts. The total of items thus disputed is approximately $700,000, practically all of which relates to overhead items of one character or another.

"The main points of difference, however, recently raised by the Government are questions of payment to the Wright-Martin Corp. of bonus for savings and special depreciation. The contracts provided an estimated cost for motors, and such amounts as the actual cost of motors might run below the estimated cost were to be divided one fourth to the corporation and three fourths to the Government. Such bonus was computed from time to time and payment made by the Government. The contracts also provided that such plant facilities as were erected or purchased by the Wright-Martin Corp. beyond the amount which it owned at the beginning of the contracts were to be depreciated to their fair after-the-war value, and the Wright-Martin Corp. was to be paid the difference between the cost of such facilities and their after-the-war value. This value was determined either by actual sale in the case of certain machinery items, or by appraisal by independent appraisers in the case of buildings and other immovable property. The determination of the values of these facilities was made in accordance with the contract provisions and the sums for special depreciation properly paid by the Government.

Federal Suit Welcomed

"The Government now, two years after the completion of the contracts, says that the Wright-Martin Corp. was not entitled to such bonus or to such special depreciation, although both are clearly provided for in our contracts, and that it proposes to attempt to collect back from us these two items, totaling approximately $4,000,000.

"It has been utterly impossible for us to understand any portion of the Government's attitude on these matters, and our counsel advises us our interpretation of the contracts is clearly correct. We, therefore shall welcome the Government's suit as the most speedy and effectual method of bringing the matters under discussion to a final conclusion, and have not the slightest doubt that the determination of any court of justice in the country will show that the Wright-Martin Corp. not only owes nothing to the Government, but that there is still approximately $1,000,000 of additional sums due the Wright-Martin Corp. from the Government."

REPORT OF THE SUB-COMMITTEE ON THE LIMITATION OF AIRCRAFT

IN considering the limitation of aircraft as to numbers, character and use, the Committee on aircraft adopted a form of procedure which took up the various questions involved in the following order: 1 Commercial aircraft; 2 Civil aircraft; 3 Military aircraft. Heavier-than-air and lighter-than-air were considered separately since the conditions governing the two are not in all cases the same. An effort was made to determine whether or not it is possible to impose limitations upon their number, character, and use, and after discussion of the methods that might be employed to effect such limitation, whether limitation was practicable or not. This Committee feels that the desirability of placing any limitations whatever upon aircraft is a matter of policy, one which it is for the Main Committee itself to determine.

Before discussing any other phase of the matter it will be well to consider carefully the effects which would follow the imposition of the limitation upon the numbers and character of commercial aircraft which may be owned and operated by the nationals of a state. In the first place, if commercial aeronautics is allowed to follow the natural laws which have governed the development of all other means of transportation and communication, the number and character of such aircraft will probably depend on financial considerations. That is, commercial aeronautics as a business will not thrive unless the operation of the aircraft will return a substantial profit. The state may interfere with the operation of these natural laws by granting to the owners and operators of such aircraft a direct or indirect subsidy. By so doing, enterprises which would not otherwise be financially successful may be enabled to live and in this way the number of aircraft used for commercial purposes will be greater than if the natural laws of development had been allowed to take their course.

It is not easy to forsee what consequences to human progress will come in the future from the development of aeronautics in all its branches. They will certainly be marvelous where natural conditions are favorable to such development. To try to limit them now with arbitrary laws, even if these laws have the purpose of preventing war, would be in the opinion of this Committee disastrous from the point of view of world progress.

If, among commercial aircraft, we class those owned and operated for sport or pleasure or convenience, the numbers of these will depend largely upon the wealth of the nation, upon the inclination of the people toward aeronautics and upon the cost of the aircraft thus employed.

The development of aircraft has presented the world with a new and improved means of transportation and communication. One of the causes of warfare in the past has been a lack of the proper distribution of the world's resources in raw material, food products, and the like. Another potent cause of war has been the lack of understanding between races, peoples and nations. Any addition to the transportation and communication facilities of the world should operate to improve the distribution of resources and likewise to lessen the causes of misunderstandings between peoples, and thus lessen the causes of warfare. Any limitation, therefore, placed upon commercial aeronautics would have the effect of limiting a means of transportation and communication between the different parts of the same state and between different states. It seems inconceivable that any limitation should be imposed upon commercial aeronautics unless it were with the avowed object of thereby limiting the air power of a state and thus decreasing the liability of war. Commercial aeronautics with its attendant development of an aeronautical industry and a personnel skilled in the manufacture, operation, and the maintenance of aircraft does furnish a basis of air power. The development of commercial aeronautics and the development of a nation's air power are inseparable.

Speaking broadly, all aircraft will be of some military value no matter what restrictions may be placed upon their character. Some can probably be converted with but few changes into military aircraft; others can be designed so that with major or minor alterations, or even with none at all, they can be employed for military purposes. As a matter of fact, the uses of aircraft in war are many. During the World War highly specialized types were designed for special uses. Military aircraft have likewise been developed to a degree of perfection not yet reached in commercial aircraft. It is quite reasonable to suppose that similar development will take place in commercial aircraft, that they too will be especially designed for the uses to be made of them, and that they may depart quite radically from the military types used in the World War.

In military aircraft as a rule a premium is placed on performance. Consideration of initial cost, of cost of operation and of maintenance are largely disregarded. The safety and convenience of the operators and passengers are considered only as these affect their ability to perform their military duties. If, as seems evident, commercial aircraft must be specially designed for the service they are to perform in order to have a chance of being financially successful, any effort to provide for their conversion into military craft will introduce complications which will increase the cost of production and operation. This may itself automatically act as a limitation for business enterprises will not be willing to have such conditions imposed unless they are compensated in some way for the extra cost.

The war value of an airplane may be said to lie in a combination of two or more of the following characteristics:

a its suitability for offensive and defensive equipment.
b its radius of action.
c its speed.
d its carrying capacity.
e the height it can attain.

It is not desired to go too deeply into technical matters in this report. The Committee wishes, however, to point out that the peace value of aircraft is at present intimately bound up with the general characteristics which make up the value of the aeroplane in war. The last four of the characteristics enumerated above are dependent upon the relation between the amount of fuel carried, the horsepower of the engine, the lifting surface and the total weight. The Committee is of the opinion that formulae could be evolved defining the interrelationship of these factors in such a way as to limit the war value of the machine built in conformity therewith. It is more difficult to ensure that war equipment shall not be mounted in a commercial aeroplane. In this matter the Committee is of the opinion that definite rules cannot be laid down.

Radius of action is of high commercial value. A reliable air service from Europe to America in, say, 24 hours, should prove a highly profitable undertaking. Again, in countries where there is perhaps the greatest scope for the development of airways, countries of great deserts for example, radius of action is essential. Speed is plainly the characteristic on which aircraft rely to gain advantage in their competition with other means of transportation. It is not yet comfort and security but time saving that will tempt passengers, mails, and valuable cargoes from old established services. To limit speed is to stop progress, to throttle aviation in its infancy.

The power of carrying numbers of passengers or quantities of goods is of obvious commercial value and even the attainment of considerable heights may eventually be a definite requirement. As a matter of fact the success of recent experiments indicate that with special means of super-charging engines, navigation of the air will in the future utilize high regions of the atmosphere to take advantage of a less resistance of the air and of favorable high velocity winds.

The factors which comprise military performance have therefore a high commercial value, and it is the opinion of this Committee that any limitation of the character of civil and commercial aircraft must hinder the natural development of aviation, it is probable that restriction as to character will have in fact an even more adverse reaction on the progress of aviation than would be caused by a restriction on numbers.

Aircraft can be limited as to number and character by an agreement arbitrarily fixing a maximum number for each nation that will not be exceeded any by imposing technical restrictions in such a way as to limit performance.

The difference in organic law as between nations will probably prevent a single system of limitations being of universal application. Moreover, the rules or formulae whereby alone the character of civil and commercial aircraft can be limited must be detailed and stringent. At the same time, they will be easy to evade, and infringement will not be obvious to the casual glance. Measurements of horsepower, supporting surface, fuel capacity, and weight will be necessary if security against evasion is to be ensured by any other means than by trusting to the good faith of the contracting parties. No state could consent to having the nationals of another power continually inspecting all of its manufacturing plants in order to ascertain whether the limitations it imposed were being enforced.

All these points received the closest of consideration with reference to the limitation of Germany's airpower and the matter is so complicated that the final drafting of the technical

rules has not yet been completed. But taking rules as drafted and even assuming continuous inspection of a most stringent character, it appears that there are still loopholes for evasion. No rules can prevent aircraft being designed *in peace* to permit of the ready installment of larger tanks in war; engines can be made interchangeable enabling one of higher power to be rapidly installed; even carrying surface can be increased by the standardization and interchangeability of wings and other methods and it is not impossible to conceive of civil and commercial aircraft being designed with a few to ultimate war requirements.

For the above reason, the Committee is agreed that in the present stage of development of aviation a universal limitation by formulae of the character of commercial aircraft is impracticable.

Without expressing an opinion as to the desirability of abolishing subsidies for the encouragement of commercial aviation, the Committee points out that such subsidies, direct or indirect, can have a great influence on the character and number of commercial aircraft in relation to their war value. In fact, subsidies will tend to decrease the natural divergence between military and commercial aircraft and render the latter more readily adaptable to war uses. It is necessary, however, to add that indirect subsidies or other encouragement are most difficult to prevent, and even when acting in good faith governments of different nations will place different interpretations on such encouragement.

The question of whether subsidies are granted or not will have great bearing upon development of commercial aircraft in general, and will affect the future welfare of the nations. This question, therefore, can not be determined from the point of view solely of the adaptability for war uses.

In this discussion a distinction is drawn between commercial aircraft and civil aircraft; the latter will comprise all aircraft operated by a state except those which it operates in connection with its military enterprises. Civil aircraft will, therefore, include any which are state-operated in the customs service, for transporting the mails, the exercise of its police powers and the like. It is readily apparent that as aircraft operate in a medium where there are no physical barriers, they can compete in some measure with every means of transportation used on land or water. It is therefore possible for much of the transportation requirements of any state to be met by the operation of aircraft. Such aircraft manifestly are not dependent for their being upon their ability to be operated at a profit. The state will decide how best it may enforce its laws, exercise its police power, transport state-owned merchandise or mails, and the means used will be those which are most efficient and most economical from the standpoint of the state itself. The cheapest will not always be the best or the most satisfactory.

The number and the legitimate use of aircraft by any government for such civil purposes will, therefore, be limited only by the estimate placed upon the service which they can render and by the consent of the people to raising by taxation the amount of money which must be employed for their acquirement, operation and maintenance.

If the civil agencies of a state use aircraft for police or other purposes that are essentially military in character this class of civil aircraft should be discussed under the limitation of military aircraft. The number and character of such civil aircraft can be limited only by an arbitrary agreement among the states. It would, again, be utterly impracticable to set up any agency acting under authority other than that of a nation itself to regulate the number of civil aircraft owned and operated by the state.

The characteristics of lighter-than-air craft are such that limitation of number and character presents little technical or practical difficulty. It is a peculiarity of these craft that their efficiency is very intimately bound up in their size. Small airships have a war value of their own, but it is limited and they cannot be considered as offensive weapons. For example, a small vessel of this kind cannot attain any considerable height while carrying a useful load, and even if filled with non-inflammable gas its vulnerability to gun fire at the heights it could reach preclude its being utilized for such purposes as aerial bombardment. Only in large sized airships can a useful load be carried to a reasonable military height at a fair speed. Limitation of size is therefore sufficient to ensure that lighter-than-air craft should be incapable of offensive aerial action. Moreover the construction of large airships requires large shed accommodation and cannot be kept secret; in this respect they resemble surface warships. It is therefore possible to regulate their numbers and size, by a simple system of international agreement and infringements of such agreement can be readily detected without a detailed system of control.

The Committee is agreed that the possibilities of war use for large airships may still exist. Although in the later stages of the World War it appeared as if the defense had the mastery over attack in lighter-than-air craft, the introduction of larger craft filled with non-inflammable gas and carrying their own protective airplanes may again permit bombardments being carried out by airships. This Committee desires, however, to draw attention to the fact that airships become increasingly efficient with increase of size. Any limit which is imposed on the size of commercial airships must shut the door on the possibility of their development for legitimate civil enterprises.

The Committee is of the opinion that it would be useless to attempt to lay down a rule that civil and commercial aircraft should not be used in war, as they consider that no nation could deny itself the value for war purposes of their commercial machines provided that they are suitable for any warlike purposes. It is understood that when so used they will be manned by service personnel of the State and carry the proper distinguishing marks, and will in fact become war aircraft; their use does not therefore require discussion in this part of the Commttee report.

The use of civil and commercial aircraft in peace is governed by the International Air Convention which amply safeguards a State's sovereignty in the air against abuse. This Convention has already been ratified by Great Britain, France, Japan, Belgium, Greece, Portugal, Serb-Croat and Slovene State and Siam. It will at a very near date come into force for these various Powers and later for the other signatory states, and also non-signatory Powers who desire to adhere to it.

Summary

This Committee understands that the purpose of this Conference is to promote peace and to remove the causes of warfare. It must be understood distinctly that if the Conference decided to limit the development of commercial aircraft in order to retard the development of air power, the immediate result will be the retarded development of means of transportation and communication which will itself, if unrestricted, largely act to bring about the same result, the removal of some of the causes of warfare.

This Committee is unanimously of the opinion that in the present state of development of aeronautics there is a technical possibility of the limitation of numbers, character and use of civil and commercial aircraft with regard to their utilization in war; they are, however agreed that such limitation of numbers and especially of character is not practicable, except in the case of lighter-than-air craft of above a certain displacement.

As regards the desirability of limitations the Committee has touched on those factors which must be understood before arriving at a decision. It feels it to be a duty to lay great stress upon the following fact which will have a decided bearing upon any determination of the proper policy to be adopted: Any limitation as to number and character of civil and commercial aircraft, heavier-than-air or lighter-than-air, which is efficacious to hinder their utility for war purposes, must interfere disastrously with the natural development of aeronautics for legitimate civil and commercial enterprises. To limit the science of aeronautics in its present state is to shut the door on progress. It is for the Conference to decide whether the limitations which can with difficulty be devised and imposed are to be adopted at such a cost.

Military Aircraft*

The Committee agreed that before entering upon a discussion of possible limitation of the numbers of military aircraft, it was desirable that the present relative air strength of the nations represented should be ascertained and tabulated in a simple form designed to facilitate comparison between them. It is remarked that though these forms afford a guide to the relative military air strength at the present day, it is impracticable to present a complete estimate of a nation's air power, since air power is (as has been already shown) intimately bound up in factors other than the military establishment. Differences in organization and administration of the various national aerial forces are a further obstacle to direct comparison in detail; these factors must not be forgotten when studying the statement presented and must be kept in the foreground of all discussions as to the possibility of limitation.

The limitation of the number of military aircraft presents from one point of view less difficulty than the similar problem in the case of commercial aircraft. It is obvious that if a limitation on the number of military aircraft is agreed upon between nations, it can be imposed by a state without that interference with the liberty of citizens which complicates the question of aircraft devoted to commercial pursuits. But when the details of such an agreement are considered, it will be found a matter of great difficulty to find a reasonable basis

* In the part of the report which follows the word "military" is used in its widest sense to denote "pertaining to the fighting services whether naval, military, or air."

on which the allotment of relative strength can be made. For example:

a. The *status quo* cannot serve as a starting point, since the state of development of air services differs widely in the case of the various powers, and in no case can these services be considered as complete.

b. The size of a nation's Navy and Army will influence the basis, in so far as aircraft are essential auxiliaries to those services.

c. National policy will differ as between nations: some nations, for example, will wish to have large air forces for coast defence where others prefer to trust to older methods. Development on the lines of the substitution of air forces for other forms of force are likely to be considerable.

d. The potentialities of air forces in policing and garrisoning semi-civilized or uncivilized countries are as yet only partially realized. The number of aircraft required for such duties will vary with the size and nature of the territories to be patrolled and with the value placed on their services by different nations.

e. The geographical position and peculiarities of a state, the situation and strength of its possible enemies, and the nature of a possible attack must influence the number of aircraft it will desire to maintain.

f. Different terms of service for personnel will influence the effectiveness of air services and the size of the reserve.

g. The state of development or possibilities for civil aeronautics will have, as has been shown above, a direct bearing on the number of military aircraft which it may be desirable for a state to maintain.

The problem of finding a suitable ratio between the air forces of various powers is thus at the present time almost insuperable.

But even should it be possible to fix the ratio, such a limitation would be of little value without some limit as to the character of the aircraft. When the question of limitation of naval armaments was considered by the Conference it was found necessary to limit the displacement of individual ships as well as the total tonnage. In the absence of similar provisions the limitation of numbers of aircraft would only result in competitive building of aircraft of greater and greater power and size. The methods of limitation must, therefore, attempt to legislate for both number and character.

The following methods may be employed:

1. The limitation of the number of military aircraft.
2. The limitation of the amount of horsepower for military aircraft.
3. The limitation of the lift tonnage for military aircraft.
4. The limitation of personnel for military aircraft.
5. The limitation of military aircraft budgets.

These five methods may be applied in combination or singly and are considered in detail below:

Limitation of the number of aircraft is the most obvious method of limiting the strength of the aviation force, but in attempting to apply this method the question of size and type at once arises. In order to make an effective limitation of the numbers of military aircraft to be maintained in peace time by any nation, it will be necessary to have a detailed understanding on the following points:

1. On the number and types actually in use by organized aerial units.
2. Total horsepower in assembled engines.
3. On the number and type of engines held in reserve.
4. On the replacement of planes crashed, worn out, or replaced by later models. In the case of obsolete and other planes that are replaced by other models it would be necessary to enter into an agreement regarding the disposal of planes so replaced. Otherwise it would be possible to build up an unlimited war reserve merely by classifying the planes so held as obsolete, or by converting them into civil or commercial planes.
5. On the limitation of the adoption of new and more powerful types.

The second method of limitation, limitation of horsepower, may apply to:

1. Total horsepower in assembled planes.
2. Total horsepower in assembled engines.
3. Horsepower in a single individual plane of a given type.

The third method of limitation, limitation of lift tonnage, may apply to:

1. Total lift tonnage in assembled planes.
2. Total lift tonnage in all planes assembled or not assembled.
3. Lift tonnage of a single individual plane of a given type.

Any method must presumably be based on wing area and horsepower. It has been mentioned that the actual horsepower may be unknown and it is likewise conceivable that a nation may discover a wing shape of extreme lifting efficiency and neglect to disclose the fact. Limitation of lift tonnage may therefore be wholly illusory.

The fourth method of limitation, whether of the total of organized personnel for war aircraft, or only of pilots in the permanent military establishment, fails by reason of the difference in organization between different states. A nation which has a separate air service has to include in its organized personnel, those employed in recruiting, supply, transport, administrative headquarters, etc., etc. In the case of nations whose air forces are contained in their naval and military forces, supply, etc., personnel are included in naval and military establishments; a fair comparison cannot therefore be made. Moreover the difference in terms of service, long or short, voluntary service or conscription, must introduce incalculable factors which directly affect the efficiency of organized air forces and the size and efficiency of the reserve.

The fifth method of limitation, limitation by means of limiting the budget and thereby controlling the amount of money that may be spent annually for aviation, seems simple in theory but it is difficult of application. The various methods of distributing budgets for material under different sub-heads make it impracticable to determine or compare the actual sums expended exclusively for aircraft and the question is at present further complicated by the factor of the relative purchasing power of the currency of various nations.

Impossibility of Limitations

Of the five methods of limitation, limitation by lift tonnage or horsepower appears to present the least objections, but to make these or any other methods effective, it would be necessary as previously pointed out to organize a system of international inspections. Any system of international inspection would be almost certain to arouse ill-feeling and would tend to cause friction rather than to insure harmony and good feeling between friendly powers.

Objections in detail to each suggested method of limitation have been advanced above—there is one insuperable objection which is common to every method, namely the close relationship which at present exists between civil or commercial aeronautics and air power. Unless civil and commercial aeronautics are strictly limited—and it has been shown in the early part of this report that it is not practicable to limit them—a nation desiring air power in excess of the limit imposed or agreed to will develop its civil and commercial aeronautics to any extent desired.

Granted a flourishing aeronautical industry, the number of the present type of perishable military airplanes active on any give date is only one of the elements of air power. During the war a single American firm contracted to deliver 100 aircraft a day, and the output of engines can be organized on a similar scale. A nation's air power can thus be multiplied not only by the actual number of civil and commercial aircraft in use but also by the capacity of the industry to turn to the manufacture of military aircraft in large quantities. Limitation of the number of horsepower and lift tonnage would under such conditions prove illusory. This commercial industry will further provide a great potential reserve of pilots and skilled technical personnel and will thus discount to a great extent any limitation of numbers of the personnel of military aviation.

Many of the remarks already made apply to lighter-than-air craft but, as in the case of commercial aircraft of this nature, limitation is both possible and practicable. It is unnecessary to recapitulate the argument that the military value of an airship is dependent on its size, and the size of airships and the number maintained can be limited by agreement of a few simple rules. Infraction of such rules can be rapidly ascertained without detailed inspection. But such a limitation of lighter-than-air aviation forces would not effect a limitation of this kind of air power of a nation unless a limitation were also imposed on its lighter-than-air commercial activities. The line of demarcation between the large commercial airship and the military airship is very slight, and a commercial airship would require little, if any, alteration in order to adapt it to military purposes. The objections to the limitation of the number or character of commercial lighter-than-air craft have already been remarked on.

It is necessary in the interests of humanity and to lessen the chances of international friction that the rules which should govern the use of aircraft in war should be codified and be made the subject of international agreement. The matter has been considered by this Committee in connection with a draft code of "Rules for aircraft in war" submitted for remarks by the Committee on the laws of war. The subject appears to the Committee to be one of extreme importance and one which raises far reaching problems, legal, political, commercial and military; it requires therefore exhaustive dis-

cussion by a single committee in which experts on all these issues are assembled.

This Committee recommends therefore that the question of the rules for aircraft in war be not considered at a Conference in which all the members are not prepared to discuss so large a subject, but that the matter be postponed to a further conference which it is recommended be assembled for the purpose at a date and place to be agreed through diplomatic channels.

General Summary of Conclusions

The Committee are agreed that among the more important elements which influence the power that a nation may exert by means of aircraft are the following:

1. The adaptability of its people to aeronautics.
2. Geographic location and characteristics of the territory occupied by the nation and its dependencies.
3. The ability to produce and maintain aircraft and accessories.
4. The amount and character of aeronautical activity outside the military establishment, such as commercial and civil aeronautical activities, and sport and pleasure flying.
5. The size and efficiency of its air establishment for military purposes consisting of (a) the active establishment including permanent headquarters, bureaus, squadrons, schools, technical establishments, depots of material and personnel, etc., (b) the reserve establishment including organized and unorganized reserve personnel and war reserve of material.

1. *The adaptability of a nation to aeronautics.* Interest of the general public in aeronautics seems to be inherent in some nations; in others it is dormant or almost lacking. The confidence of a people in aeronautics in general is undoubtedly a factor worthy of serious consideration when estimating the air power of that country. It is possible that a far seeing government may stimulate the interest of its general public in aeronautics by exhibitions, general educational measures, and by the encouragement in a financial way of individuals already interested, and thus increase the adaptability of its people to aeronautics.

2. *Geographic location and chaaracteristics of the territory occupied by the nation and its dependencies.* This may be looked on as closely akin to 1.

3. *The ability to produce and maintain aircraft and accessories.* The maximum aeronautical industry possible for a nation to build up under ideal conditions is determined by *a* the extent to which manufacturing in general is carried on; *b* by the character of articles manufactured; *c* by the manufacturing methods in general, that is whether articles are manufactured by machinery or by hand; *d* the supply and availability of essential raw materials. In the manufacture of many articles the raw materials used and the manufacturing methods are similar to those employed in the manufacture of aircraft and accessories. The amount of this class of manufacturing carried on in any country is an essential factor in estimating the ability of a nation to produce aircraft.

The ability to expand an existing aeronautical industry rapidly enough to meet war conditions is one of the most important elements of air power. This may be estimated by *a* the number of individuals skilled in the manufacture of aircraft and accessories; *b* the number of individuals whose training in industries similar to the aeronautical industry forms a basis for learning readily and rapidly the special problems encountered in the manufacture of aircraft and accessories; *c* the size and condition of the existing aeronautical industries and the size and number of manufacturing concerns that can readily be converted to the manufacture of aircraft and accessories; *d* the existence of a definite program previously determined upon and the extent to which orders have been previously placed in anticipation of an emergency with a consequent perfection of plans; *e* the amount and state of availability of the essential raw materials; *f* the quantity of available jigs, tools, dies and production drawings for going into quantity production of standard equipment.

4. The amount and character of aeronautical activity outside the military establishment has been exhaustively discussed under the Limitation of Civil and Commercial Aircraft.

5. *Existing establishment of aircraft used for military purposes and the reserve.* The size of the organized reserve will depend upon the size of the military establishment and the rate at which members of the military establishment are trained and returned to civil pursuits. Any reduction in the permanent peace-time establishment will carry with it a consequent reduction in organized and trained reserves. There is, however, a type of personnel whose civil pursuits fit them for immediate service in the air establishment. This class is made up by those engaged in commercial and civil aeronautics and industrial pursuits which require the same trades and basic knowledge and experience as is required in the operation and maintenance of military aircraft. This class will not be seriously affected by any change in the military establishment.

Technical considerations have led the Committee to the conclusion that the limitation of the fifth element, namely, the size and efficiency of peace-time air establishments for military purposes (including the active establishment and the organized reserve), although theoretically possible, is not practicable. The Committee also desires to lay stress on the fact that, even if such limitation were practicable, it would not prevent the use of air power in war, but would only operate to give greater comparative importance to the other elements of air power which cannot be limited for the reasons given in the report.

Final Conclusions

The Committee is of the opinion that it is not practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military, excepting in the single case of lighter-than-air craft.

The Committee is of the opinion that the use of aircraft in war should be governed by the rules of warfare as adapted to aircraft by a further Conference which should be held at a later date.

Respectfully submitted by
COMMITTEE ON AIRCRAFT

For the United States of America: William A. Moffett, Chairman, Rear Admiral, U. S. N. Mason M. Patrick, Major General, U. S. A.

For the British Empire; J. F. A. Higgins, Air Vice Marshal, R. A. F.

For France: Albert Roper, Capitaine, Pilote Aviateur, French Army.

For Italy: Riccardo Moizo, Colonel, R. I. A.

For Japan: Osami Nagano, Captain, I. J. N.

NOTE: The Italian Representative believes and desires to place on record, that one way in which it would be possible to limit the air power of a nation would be by placing a limit upon the number of pilots in the permanent military establishment and consequently agrees with the general reasoning of the report in so far as it is not contrary to this opinion.

(Signed) RICCARDO MOIZO.
Colonel, R. I. A.

THE CONSTRUCTION AND TESTING OF MODEL AEROPLANES

By WALTER S. DIEHL

(Technical Note, National Advisory Committee for Aeronautcis)

Introduction

IN most wind tunnels the construction and test of a model aerofoil or fuselage is standardized, but in the endeavor to secure a non-turbulent air flow and great refinement in force measurements, the general requirements for construction and tests of model aeroplanes or seaplanes have been neglected. The average aeroplane model is constructed to scale from general assembly plans with detail depending on the skill of the model maker. As one result the cost of a model is very high. As another result the test data is frequently unreliable.

The following notes are intended to supplement Mr. F. H. Norton's paper on "The Construction of Models for Tests in Wind Tunnels" (National Advisory Committee for Aeronautics, Report No. 74). It will be shown that the construction of an aeroplane model can and should be simplified in order to obtain the most reliable test data.

General Requirements in Model Construction

The general purpose of the usual wind tunnel tests on a model aeroplane is to obtain the aerodynamic characteristics, the static balance, and the efficiency of the controls for the particular combination of wings, tail surfaces, fuselage and landing gear employed in the design. These parts must be exact scale reproductions. Any appreciable variation from scale

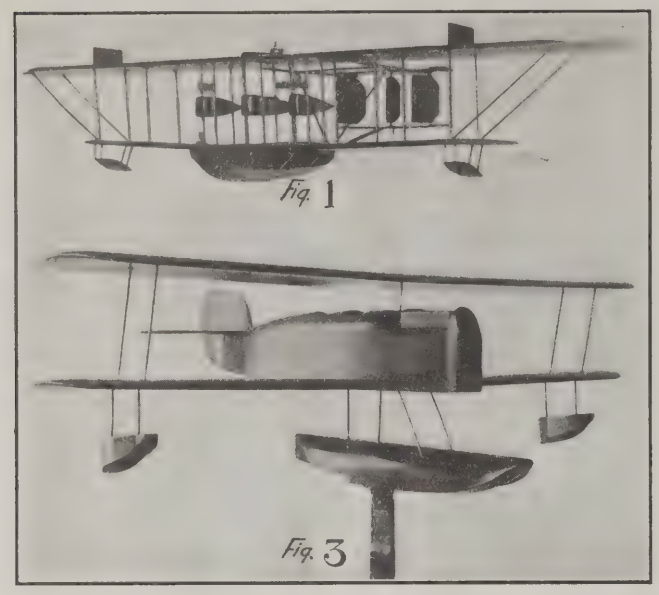


Fig. 1

Fig. 3

reproduction must be in the remaining parts of the model, *i.e.*, struts, wires, fittings, control horns, radiators, engines and the various attachments found exposed to the wind in special aeroplanes.

Obviously the wings, tail surfaces, fuselage and landing gear must be rigidly held in the proper relation, one to another, preferably with means for minor adjustments. These requirements are easily met in models of internally-braced monoplanes, but they usually cause trouble in models of multiplanes, particularly when an attempt is made to provide an *exact scale reproduction* of the interplane bracing in accordance with the popular conception of model requirements. Although model struts and fittings are very minute and difficult to make, their use would be justified if a model so constructed was rigid and capable of minor adjustments and if it in test fairly represented the full scale aeroplane.

Interplane Bracing

Figure 1 represents an average attempt to secure an exact scale reproduction in a wind tunnel model. The result is a flimsy affair which is not only difficult to line up, but also difficult to keep adjusted. The values of drag obtained from tests are from 20% to 50% higher than the values obtained from calculations, which allow for a normal scale effect. This great difference in drag is due to the obnormal scale effect for struts and wires at low values of VL. Figure 2 is included to illustrate the magnitude of this scale effect. The average full scale strut, say 2" thick at a velocity of 100 f.p.s., has the following characteristics:

$$VL = 16.7$$
$$D_c = 0.042$$

For a 1/24 scale model tested at 50 f.p.s., the characteristics will be

$$VL = \frac{16.7}{24 \times 2} = 0.35$$
$$D_c = 0.180$$

Consequently, the resistance of a model strut is about four times as great as its proportional full scale value.

The scale effect on wires and cables is about one-half of the scale effect on struts. The scale effect on fittings is unknown, but it is reasonable to assume that it is of the same order as that for the wires. It therefore appears useless to employ an exact reproduction of the interplane bracing on models. This fact has been recognized in the construction of certain models, in which, according to the test reports, the omission of interplane wiring was supposed to allow for the scale effect on the struts. This assumption is hardly justified in general use although it may give a fair approximation in those cases having a certain degree of balance between the struts and wires. Even with this simplification there still remain the requirements of rigidity and minor adjustment which are always difficult to meet with in the model streamline struts.

As the result of investigations made at the Washington Navy Yard wind tunnels and extending over a period of three years, it has been concluded that the best results are obtained by omitting all of the struts, wires and fittings, as such, and holding the model together with the fewest possible number of small cylindrical brass struts consistent with rigidity and adjustment. These struts are usually fitted in symmetrical pairs without reference to the location of struts on the full scale aeroplane. It is found that three pairs are sufficient for the average biplane model. Adjustment is obtained by fitting the struts with R.H. and L.H. threads into corresponding bushings in the lower and upper wing. The diameter of the wire used depends upon the size of the model and varies from 0.030" to 0.100", the average being approximately 1/16".

Tests have shown that the lift of these wires is negligible and that their drag is substantially constant over the usual range of flying angles. A very close approximation to the true model scale drag of the aeroplane may therefore be obtained by correcting the observed model drag for the difference between the drag of the cylindrical struts and the scaled down value of the calculated drag for the full scale interplane bracing, i.e.,

$$D' = D - D_w - D_c$$

where

D' is the corrected model drag
D the observed model drag
D_w the drag of the cylindrical struts

used on the model, and D_c the calculated model equivalent on the full scale interplane bracing drag, assuming that it varies as $(VL)^2$. Since this assumption is always made in converting the model test data to full scale values, the preceding operation is, in effect, the equivalent of a scale correction for the interplane bracing.

Corrections may also be made to pitching moments if desired. It is recommended that in each case the moment of $(D_c - D_w)$ about the c.g. be compared with the total moment in order to weigh the necessity of this correction. In most cases it may be neglected.

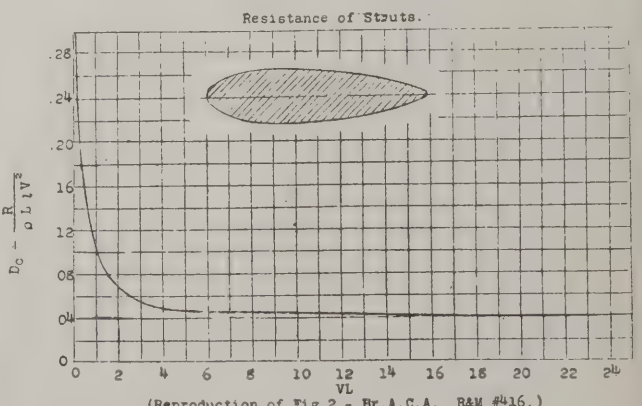
Minor Detail

The construction of the model may be further simplified without affecting the accuracy of the test results. For instance, the control cables, and in most cases the control horns, should be omitted and their resistance included in the correction D_c.

Radiators have approximately one-half of the resistance of a flat plate of equal frontal area. Free air radiators may therefore be approximated by a flat plate whose linear dimensions are 70% of those of the radiator. In case there are objects in the wake of the radiator it is desirable to use a piece of gauze which has a resistance coefficient equal to radiator core. Nose radiators should be made according to the method described in N. A. C. A. Report No. 74.

Very little detail should be used on engine cylinders, wind shields, wing skids, tail skids, shock absorbers, etc. These parts have very little effect on the total resistance and it has been found that the extra labor required to put in the detail is not justified.

Figure 3 represents the appearance of a model which embodies in its construction the foregoing simplifications. This model is rigid and easily adjusted; on test it gives satisfactory results. The cost of construction is reduced approximately 50% compared with an exact scale model.



(Reproduction of Fig.2 - Br.A.C.A. R&M #416.)
Fig. 2.

NAVAL and MILITARY AERONAUTICS

Naval Aviation Officers to Germany

The first detachment of Naval Aviation officers ordered to Germany to supervise and inspect the construction of the L71 type rigid airship authorized by the Allied Council has left the United States.

Lt. Comdr. Zachary Lansdowne, U. S. N., who has been in charge of the Lighter-than-Air branch of the Bureau of Naval Aeronautics was detached from that service on Jan. 16 and detailed as Assistant Naval Attache at Berlin, Germany, where his duties will also include the supervision of the German commercial airship soon to be undertaken at Friederichshafen, Germany. Commander Lansdowne, an expert on lighter-than-air craft made the trans-Atlantic trip on the British airship R-34 in July 1919, being the only American on the trip over.

Lt. Comdr. G. Fulton, of the construction department of Naval Aviation, has been ordered to proceed to Germany to organize a bureau of aernautical inspection.

It is understood that Lieut. R. G. Pennoyer, a survivor of the American ZR-2 detachment Howden, may also be detailed to inspection duty in connection with the building of the Navy's great rigid airship.

Staff of Naval Bureau of Aeronautics

The officers at present on duty in the Bureau of Aeronautics, Navy Department, are as follows:

Chief of Bureau—Read Admiral W. A. Moffett, U. S. N.

Asst. Chief of Bureau—Capt. H. C. Mustin, U. S. N.

Aide to Chief of Bureau—Comdr. W. J. Giles, U. S. N.

Administration Division—Comdr. V. K. Coman, U. S. N.; Lt. Comdr. R. M. Griffin, U. S. N.; Lt. Comdr. S. H. Quarles, U. S. N.

Plans Division—Comdr. T. G. Ellyson, U. S. N.; Lt. Comdr. Z. Lansdowne, U. S. N.; Lt. Comdr. W. Capehart, U. S. N.; Lieut. F. H. Becker, U. S. N.

Flight Division—Lt. Comdr. E. W. Spencer, U. S. N., Lt. R. G. Penoyer, U. S. N.; Lt. A. W. Radford, U. S. N.; Lt. G. Morgan, U. S. N.; Lt. W. L. Richardson, USNRF.; Lt. C. N. Keyser, USNRF.; Lt. W. F. Reed, USNRF.; Lt. F. W. Neilson, U. S. N.

Material Division—Comdr. E. S. Land, (CC) USN.; Comdr. J. C. Hunsaker, (CC) USN.; Lt. Comdr. S. M. Kraus, USN.; Lt. Comdr. G. Fulton, (CC) USN.; Lt. Comdr. B. G. Leighton, USN.; Lt. Comdr. G. B. Wilson, USN.; Lt. W. S. Hactor, USN.; Lt. K. McGinniss, USN.; Lt. K. B. Bragg (CEC) USN.; Lt. V. R. Dunlap (CEC), USN.; Lt. W. S. Diehl (CC), USN.; Lt. C. B. Harper, (CC), USN.; Lt. R. D. MacCart (CC), USN.; Lt. C. J. McCarthy (CC) USN.; Lt. E. W. Rounds (CC) USN.; Lt. C. H. Congdon (CC), USN.; Lt. H. W. Roughley, USN.; Lt. E. F. Stone, USCG.; Lt. B. G. Bradley, USMC.; Ensign C. E. Bauch, USN.; Ensign F. Miller, USN.; Ensign W. Miller, USN.

Headquarters, U. S. Marine Corps Aviation—Lt. Col. T. C. Turner, USMC.; Capt. R. E. Williams, USMC.

The Commanding Officers and executives of air stations and fleet air detachments are as follows:—

Naval Air Station, Pensacola, Fla.—Capt. H. H. Christy, USN.; Comdr. J. H. Towers, USN., Captain of the Yard.

Naval Air Station, Hampton Roads, Va.—Capt. S. H. R. Doyle, USN., C. O.; Lt. Comdr. G. C. Dichman, USN., Executive.

Naval Air Station, Lakehurst, N. J.—Lt. Comdr. J. P. Norfleet, USN., C. O.; Lieut. A. R. Houghton, USN., Executive.

Naval Air Station, Anacostia, D. C.—Lt. Comdr. C. Y. Johnston, (Ordered); Lt. H. J. Brow, USN., Executive.

Naval Air Station, Coco Solo, C. Z.—Lieut. F. W. Byers, USN.

Naval Air Station, San Diego, Calif.—Comdr. F. R. McCrary, USN., C. O.

Naval Air Station, Pearl Harbor, T. H.—Lt. Comdr. R. D. Kirkpatrick. USN., C. O.; Ensign N. M. Kindell, USN., Executive.

U. S. Atlantic Fleet Air Squadrons,—Capt. A. W. Johnson, USN., Comdr; Comdr. A. C. Read, USN., Exec. Aide.

Air Boat Squadrons—Lt. Comdr. H. B. Cecil, USN., C. O.; Lt. W. D. Thomas, USN., Exec.

Torpedo Plane Squadrons—Lt. Comdr. H. T. Bartlett, USN., C. O.; Lt. E. L. Ericson, USN., Executive.

U. S. Pacific Fleet Air Squadrons—Capt. H. V. Butler, USN., Comdr.; Lt. Comdr. P. N. L. Bellinger, USN., Exec. Aide.

Spotting Squadron No. 4—Lt. Comdr. M. A. Mitscher, USN., C. O.

Combat Squadron No. 4—Lt. Comdr. W. Masek, USN., C. O.

Spotting Squadron No. 3—Lt. Comdr. G. D. Murray, USN., C. O.

Combat Squadron No. 3—Lieut. F. W. Wead, USN., C. O.

Patrol Squadron—Lieut. G. L. Compo, USN., C. O.

The Marine Corps Aviation activities and the Commanding Officer of each are as follows:

Marine Flying Field, Quantico, Va.—Maj. Roy S. Geiger, C. O.

First Air Squadron, Santo Domingo City, D. R.—Maj. Alfred A. Cunningham, C. O.

Fourth Air Squadron, Port au Prince, Haiti—Maj. Francis T. Evans, C. O.

Flight "L", Sumay, Guam, M. I.—Capt. Ralph J. Mitchell, C. O.

Marine Flying Field, Parris Island, S. C.—2nd Lieut. Willard R. Enk, C. O.

Marine Aviation Detachment, Naval Training Station, Great Lakes, Ill.—Capt. Benjamin Goodman, C. O. (This officer will be relieved on January 15, 1922, by Marine Gunner Frank F. Puttcamer).

Langley Field News

The Chief of Air Service in a telegram to the Commanding Officer of Langley Field, advised him that a sum sufficient to recondition all motors and planes at this station had been alloted.

Lt. Carl A. Cover, Engineer Officer at this station, is making the necessary preparations to go ahead with the work which will be necessary to put all of the flying equipment in flying condition.

The equipment consisting of several hundred Liberty Motors and approximately one hundred planes of all makes was used during the bombing tests last July and was left in a very run down condition. The bombing tests were followed by a great reduction of the Army which made it impossible to do any work in the nature of overhauling this equipment, as there were scarcely enough men left to keep the new equipment in running order.

Lt. Cover said that it would be necessary to employ fifty or sixty expert motor mechanics in order to complete this work during the present fiscal year.

It is probable that the Engineering Department will experience very little difficulty in securing locally, the required number of motor mechanics. Many applications have already been received at the Engineer Office and they continue to come in.

From now until July will be the most active period that we at Langley Field, have experienced since the war.

The advantages of having this work done at this time are: First, it will give the Air Service a lot of serviceable material almost as good as new and while doing it will give work to a number of skilled mechanics who otherwise would not be employed.

Helium to Be Compressed

Newport News.—The world's supply of helium, incased in the bag of the dirigible C-7 at the Hampton Roads naval base, is to be compressed and sent elsewhere. Orders to this effect have been received and the C-7 is to be deflated before February 1.

The gas, it is understood, will be taken to another station for experimental purposes.

General Patrick Visits Langley Field

Major General Mason Patrick, Chief of Army Air Service visited Langley Field recently and inspected the giant Airship Roma at the Lighter-Than-Air station, and the Machine and Aerial Repair Shops which are a part of the Engineering Department at the Heavier-Than-Air Station.

The General also inspected the Barracks and quarters of the enlisted personnel. It is understood that he was not entirely pleased with the buildings used for barracks and quarters, and will attempt to get appropriations sufficient to build better barracks.

The General was the guest of Col. and Mrs. Charles H. Danforth during his visit here. There was a reception and dance at the Club in his honor, which was attended by all the officers and ladies of Langley Field.

FOREIGN NEWS

Airmen Bombard Moors

Melilla—Spanish aviators in Morocco have destroyed numerous native settlements of the Beni-Said tribe. This resulted in the chieftains sending a delegation to the Spanish military authorities pleading for a cessation in the bombardment and offering to submit to the Spaniards.

Aviators are preparing to bombard another centre of concentration. In the course of the morning it was reported that a number of the most recalcitrant chieftains had gathered there with their followers.

Air Mail Stamp Issues

Hitherto the stamps issued by the French Government for use in connection with air mail services in certain of their colonies have been "provisionals." Commencing with the new year, however, it is stated that a special set of three stamps—75c blue, 1 fr. red and 2 fr. violet—is to be issued for use in French air mail service in Morocco. They will have an appropriate design, showing an aeroplane flying over Casablanca.

Another air mail stamp has just been issued by the Newfoundland Post Office, two previous issues having made their appearance on the occasion of the Hawker and Alcock Transatlantic flights in 1919. This new stamp has been brought into use in connection with the experimental service between St. John's and Halifax, N. S., and consists of the 35c Cabot (1897), which has been overprinted "Air Mail to Halifax, N. S., 1921" in three lines. Some 14,000 of these stamps have been issued, and it is said that about 5,000 have been actually used on the service. In connection with the above service it may be of interest to note that the pilot is, we believe, F. S. Cotton, who flew a D.H.14 in the 1920 Aerial Derby.

A Fairey Weight-Lifter

Hitherto it has been the fashion, at any rate where seaplanes are concerned, to employ twin-engined machines when great loads had to be carried. This precedent now appears to have been destroyed by a Fairey single-engined seaplane, which has carried a useful load of 3,100 lbs. The machine is a tractor seaplane, with Rolls-Royce "Eagle" engine, and as the total weight lifted was 7,250 lbs., the power loading was about 20 lbs. h. p. Incidentally this performance probably constitutes a record for weight lifted by a single-engined machine of this power.

French 1922 Air Budget Details

Last week, details of the French Air Budget for 1922 were available, and total, as passed by Parliament, to just under 436 million francs. The main appropriations are: *Minister of War:* For Home Squadrons, 214,287,500 francs; Algeria and Tunis, 9,936,490 francs; Morocco, 22,173,092 francs. Total, 246,397,082 francs. *Under Secretary of State Department for Aeronautics:* 147,219,970 francs, which includes foreign air attachés, 200,000 francs; technical service, 5,400,000 francs; prizes and subsidies for commercial aviation, 45,382,000 francs. *Ministry of Marine:* 37,318,543 francs. *Ministry of Colonies:* 4,991,000 francs.

Air Traffic at Bourget, the Paris Air Port

Of considerable interest and importance are the figures now available for the past year's growth of flights and passengers and freights carried. For the month of December, the figures are: 148 flights (arrivals and departures), 359 passengers, 7,277 kilogs. of freightage, and 84 kilogs. of mails. For the full 12 months to December 31, 1921, last (compared with 1920) the figures are: Flights, 4,022 (3,359 in 1920); passengers, 13,369 (6,850 in 1920); goods, 150,309 kilogs. (120,745 in 1920); mails, 3,308 (1,474 in 1920).

These figures are for the airways in operation between Paris and London, Paris-Brussels-Amsterdam, Paris-Strasbourg-Prague-Warsaw, Paris-Amsterdam and Paris-Havre.

Rumpler's Figures in Germany for 1921

Over the Berlin-Augsburg air-route, which the Rumpler Co. have been exploiting, the totals for 1921 are given as 1,244 passengers and 3,286 kilogs. of mails carried.

Syria and Aviation Development

A new air service has been instituted in Syria between Latakia and Homs. Two journeys each way are, according to the Paris *Temps*, made per week, as on the similar services between Aleppo and Deir-Zor, Aleppo and Aintab, and Aleppo and Alexandretta. Services are also to be opened between Damascus and Palmyra and Damascus and Soweida (Hauran). A number of packages were carried on the Levant services, and in November 31 wounded or sick were evacuated by aeroplane without accident.

The Giant Caproni

Recently rumors have appeared that the Caproni firm were again building a big triplane on the lines of the machine which disappeared in Lake Maggiore. One learns from Italy that this rumor is entirely untrue. Both the Caproni brothers are away from Milan and the Caproni works at Vizzola, near Lake Maggiore, and at Taliedo, near Milan, are both closed down, no work having been done for several months.

Soaring Competition in Switzerland

A soaring flight competition is to be held by the Central Swiss section of the Swiss Aero Club at Gstaad, Bernese Oberland, from March 8th to 15th, 1922.

In connection therewith a course of instruction in practical soaring is being arranged at Gstaad from Feb. 15th to March 15th.

Intending participants in the competition should communicate with the Secretary, the Royal Aeronautical Society, 7 Albemarle Street, London, W. 1.

Aero Club of France President

As we foreshadowed, M. P. E. Flandin was, at the last meeting of the Executive Committee of the Club, elected President in place of M. Michelin, who recently resigned owing to ill health—not fortunately through the death of this great patron of sport, as by a regrettable slip was erroneously stated last week. M. Flandin headed the voting list with 24, and from his past official connection with aviation should prove an active and valuable advocate of aeronautical progress.

Germany and Russia

The *Times* stated on Jan. 11th that a notice in the German Press states that the Moscow Soviet has approved a draft agreement with a German air line company for a regular service of postal and passenger aeroplanes between Moscow and Berlin via Kovno and Konigsberg. It is added that the Lithuanian and Lettish Governments have given their assent to the scheme.

Abolition of Air "Corridors"

The regulations which have hitherto been in force relating to the "corridors" by which aircraft might enter and leave the U. K. have now been abolished, according to an Air Ministry "Notice to Airmen," which states: "The provisional agreement relating to aerial communication between Great Britain and France (Article 12) has been amended in the following respect:—"That corridors of entry into Great Britain have been abolished. Aircraft may therefore cross the coast of Great Britain at any point, except over a prohibited area. The corridor of entry into France from Great Britain extends from Etaples to the Belgian frontier."

Air Mail Stamp Issues

Special issues for special flights appear to be the system employed by the Uruguay Post Office for the issue of air mail stamps. Some little time back, that country overprinted a small quantity of the 1900 25c. stamps, with the device of an aeroplane and the inscription "Correo Aero" in black. These were apparently used on some special flight (real or imaginary), and are hard to get—and expensive at that. Now a second issue has, we understand, been put out, this time the overprint being in red, for an exhibition flight that was made between Mercédès (Soriano) and Rocha. Some countries have the air stamps, and no air services, while *we* have the air service, but no stamps!

Proposed Lisbon-Paris Air Service

The Companhia Portugueza de Navegacao Aeria, it is reported, intends to open a regular air service between Lisbon and Paris shortly, with intermediary landings at Castello-Branco, Valladolid and Bordeaux. The Portuguese Government has, it is stated, placed the main aerodromes and various intermediary landing grounds on Portuguese territory at the disposal of the company gratis, and has promised that these grounds shall pass into the possession of the company in five years' time. The working capital of the undertaking is stated to be two million escudos. The following lines are projected:—Lisbon-Sines-Faro, Lisbon-Panpilhosa-Opporto, Lisbon-Portalegre-Madrid.

Air Routes in Brazil

The President of Brazil has, says *The Times* Rio de Janeiro correspondent, given his assent to an Act authorizing the expenditure of over 235,000 pounds for the establishment of two aerial routes between the capital and Porto Alegre (in Rio Grande Do Sul). The one route, which is for hydroplanes, will follow the coast, while the other will be inland, following the railways where possible.

The routes are to be inaugurated before the opening of the Centennial Exhibition next September. Their primary object is military defence, but the routes may be used for commerce, with the Government's consent. Wireless telephone and telegraph stations with a range of 300 miles are to be established at convenient points at a minimum distance of 190 miles apart, and at the terminal points there will be powerful plants capable of direct intercommunication. Modern meteorological stations are also included in the scheme.

The Second Peugeot "Aviette" Prize

Conditions governing the second prize offered by M. Peugeot of 20,000 francs for a "flight" by a man-propelled machine have now been published. The new prize was offered immediately after the first prize of 10,000 francs was won by Gabriel Poulain on his Nieuport aviette, when in a "flying" jump he covered 10 metres both ways.

The main conditions set out are that the 20,000 francs prize goes to the first man who shall cover a distance of 50 metres (164 ft.), both ways, upon any form of machine propelled entirely by muscular effort. No independent assistance, force or power may be employed except upon the condition that any instrument of propulsive assistance so used must be carried by the competitor on his machine during his "flight."

The dates for making attempts in 1922 to gain the prize are April 23-30, June 23-30, July 24-31 and September 23-30, and possibly a supplementary date.

The number of tries for each competitor is limited to three, but the judges have powers to permit, in their discretion, extra attempts.

Up to 20 minutes' interval is allowed before the return "flight" in the opposite direction is made. In case no competitor succeeds in fully qualifying for the prize, but has covered the 50 metres in one direction, he may recommence his attempts *de novo*, and the judges may permit a restart to those competitors whom, although they may not have covered the first 50 metres, they deem worthy of another attempt.

Entries (fee 10 francs, returnable under certain conditions) must be made at least 10 days prior to any of the Avieto weeks above to the Maison Peugeot, 80 rue Danton, à Levallois-Perret (Seine), in the name of the competitor, together with the name of the constructor of the machine. The competition is international, but for both competitors and machines Germany, Austria, Turkey and Bulgaria are barred. The organizing committee comprises: MM. le colonel Ferrus, Emmanuel Aimé, Jacques Balsan, Baudry, de Saunier, Charles Faroux, Isaac Koechlin, Chevalier Reén de Knyff, Lumet, Paul Panhard, Frantz-Reichel, Paul Rousseau.

Mr. Ashbolt and an Imperial Airship Service

Mr. Ashbolt, Agent-General for Tasmania, is if anything, more determined than ever that the one great necessity for Imperial linking-up is by means of an Imperial Airship Service. Last week he lectured to the members of the Victoria League, when Dame Meriel Talbot presided. His delightful lecture, illustrated with photographs, was greatly appreciated, and it is very encouraging to learn from his closing remarks that he had been practically promised support for his scheme, to the extent of four million pounds, with which to initiate the commercial airship fleet which would be necessary for the experimental two years' period.



ELEMENTARY AERONAUTICS and MODEL NOTES



A 30-Inch Flying Model of the Curtiss-Navy Racer

CAPABLE of a speed of nearly 177 miles an hour, the record-holding Curtiss-Navy racer furnishes a promising subject for model builders to reproduce in miniature. The lines of the racer lend themselves to a scale flying model bearing a very close resemblance to the real machine. Only slight departures in outline are suggested, for the location of the wings, length of the landing gear struts, etc., (features often required to be changed to balance a model) need no alteration to obtain good results in flying the model.

Specifications:

Span, both wings	30	inches
Length overall	26¼	inches
Height (when in flying position)	10⅜	inches
Wing chord	4¾	inches
Gap between wings	4¾	inches
Wheel size	2½	inches
Propeller diameter	11	inches

Attention is called to some essential features of the model design; none of the control surfaces are movable; inasmuch as a model cannot be controlled while in flight, much weight is saved by making tail surfaces and ailerons rigid.

All tail surfaces should be very light, or the correct flying balance will be difficult to obtain.

No trussing wires are necessary except for the landing gear.

For those desiring to build a model not intended to fly, the following notes will assist in making the proper corrections in the scale, which will result in more nearly correct proportions:

The wing span should be reduced to 27 inches. The propeller diameter should be 9¾ inches. The correct wing curve, the Sloane, is shown on the drawing. Wiring between the wings will add to the appearance; the correct locations of wires are indicated on the small sketch below. Ailerons are hinged all along the entire length of lower wing. No ailerons on the top wings.

Wings

The upper wing is in one panel; lower wing also in one panel. The main wing beams should be ¼" by ⅛". Bamboo ribs, leading edges and trailing edges. Ribs spaced 2 inches apart. (On the real machine, there are 43 ribs in the top wing). A deeper wing section than the "Sloane" is suggested.

Cut notches in the bottom of the body to admit lower wing beams and fill out to conform to the outlines of the drawing. Glue the wings on permanently and no bracing wires will be needed to keep the wings in shape. The solid strut between the top wing and the body should be fixed rigidly, so as to take practically all the strain from the N struts.

The N struts are made of 3/32" round rattan or reed with balsa wood strips glued to them to give the streamline shape. Ends of struts are bent nearly vertically and fit into drilled blocks in the wings. The strut blocks will hold more securely if wrapped to the spars with a few turns of silk thread, in addition to a careful application of "Amberoid" or hot glue.

Tail Surfaces

Bamboo is suggested for the entire construction of the tail units. Ribs 1/32" thick and less than 1/16" wide are sufficient. It is very important to keep the tail light.

Fuselage

The balsa body may be built up of smaller strips to give the required depth at the front end. Carve the outside completely, then saw in half, from front to rear, hollow out the inside, leaving a wall about 3/16" thick and glue the halves together again.

Motor Unit

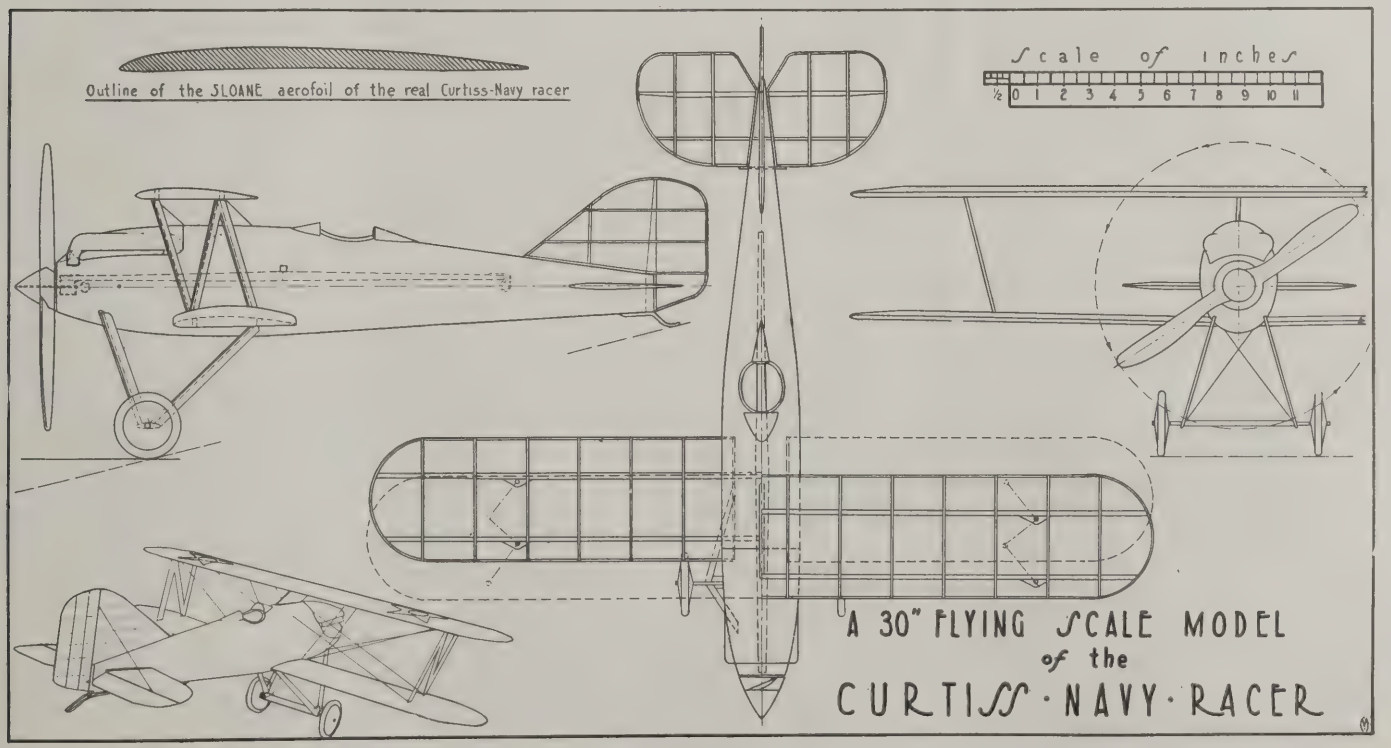
A motor-stick tapered, as shown on the drawing, will prove lighter and as strong as the flat stick generally used. Cut from a piece of spruce 17" by ⅜" square. Keep the bottom side (next to the elastic) flat, and taper all other sides from ⅜" at the middle to 3/16" square at the ends.

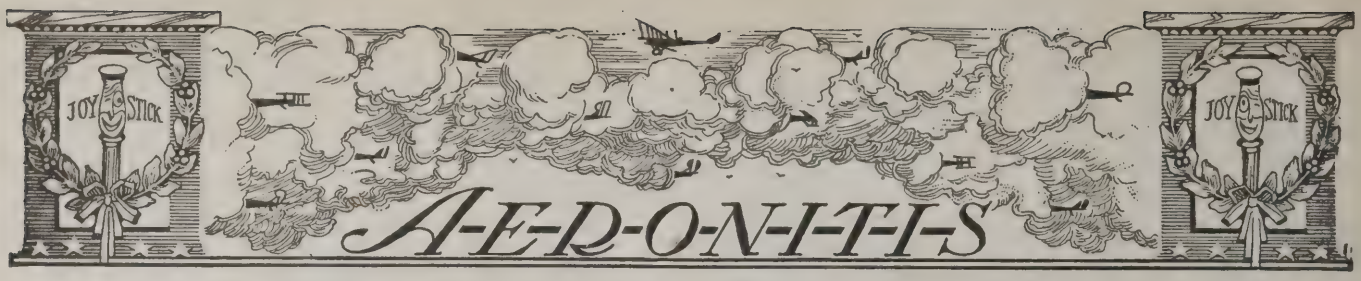
Attach the motor-stick to the body only at the front end and at the middle of the stick, but do not brace the rear end, or it may cause the body to twist and split.

About 20 feet of ⅛" flat elastic should be enough to fly the model from the ground.

General Notes

A technical description, with outline drawings, appeared in the Jan. 2, 1922 issue of AERIAL AGE. Refer also to the photograph in the Curtiss advertisement and those on page 222 of the November 14, 1921 issue. The model drawings, however, show the latest cowl outlines of the machine as it finally appeared in the race.





A Barnum of Finance

"They tell me that every minute there is a fool born into the world," said the old financier. "And," he added piously, "thank God, some of 'em live."—*Town Topics (London).*

And This Is Life

"Mr. Wadleigh, a gentleman waits without to see you on urgent business."

"Does he look prosperous?"

"He looks poor."

"In that case the urgency is his. Let him wait."—*Birmingham Age-Herald.*

? ! ?

SHE: I like your cigarette holder.

HE: Why I never use one.

SHE: Don't be so dense.—*Shady Lane.*

"Gas Overcomes Girl While Taking Bath"

—headline.

Miss Celcilia M. Jones owes her life to the watchfulness of Joel Cooley, elevator boy, and Rufus Bauson, janitor—*Dubuque Times-Herald.*

After the clock struck eleven the peevish father strode to the top of the stairs and called down:

"Mabel, doesn't that young man know how to say 'good-night'?"

"Does he?" echoed Mabel from the darkened hall below. "Well, I should say he does!"—*Court Proceedings.*

"Did you see my sunburst last night?" inquired the pompous Mrs. Newrich of her poorest neighbor.

"No, I didn't," said the poor neighbor caustically, "but I certainly thought he would if he ate another bite."—*Clipped.*

LADY (*as blood curdling war whoop is heard from the kitchen*): What is happening, Norah?

NORAH: That is Dinah. She always yells that way, ma'am, when she succeeds in turning the omelette without letting it drop on the floor. She's the daughter of a Zulu chief.—*Scalper.*

BINKS: Say, old man, do you know of any cure for insomnia?

JINKS: Counting one thousand is said to be a remedy.

BINKS: That's what everybody tells me; but the baby's too young to count.—*Tit-Bits.*

PATIENCE: How would you like to go for your honeymoon in an aeroplane?

PATRICE: Not me— I should hate to miss the tunnels—*London Opinion.*

It was visiting day at the jail and the uplifters were on deck.

"My good man," said one kindly lady, "I hope that since you have come here you have had time for meditation and have decided to correct your faults."

"I have that, mum," replied the prisoner in heartfelt tones. Believe me, the next job I pull, this baby wears gloves."—*The American Legion Weekly.*

FLATBUSH: Why do they have those cases with the axes, crowbars and other implements in 'em in the railroad passenger-cars, do you suppose?"

BENSONHURST: Oh, they are put up there to use in case some one wants to open a window.—*Yonkers Statesman.*

We sometimes wonder why the modern girl when she dresses for the ball-room doesn't get confused and go to bed. —*Dictionary.*

BOUNDER: What are all those trunks doing over there by the stage door?

ROUNDER: Why those are the chorus girls' clothes.

BOUNDER: Let's go to another show.—*Brown Jug.*

Mine?

Here's to the
Girl that is
Mine, all mine.
She drinks, and
She bets, and
She smokes
Cigarettes, and
Sometimes, I'm told,
She goes out
And forgets
That she's mine
—All mine!—*Orange Peel.*

"Is Jerry a lounge lizard?"

"Yes, but Tommy's a good lap ahead of him."

"How's that?"

"Oh, he's a garter snake."

At the Ball

MATERNAL PARENT: Our daughter is very popular to-night. Do you see her over there surrounded by admirers?

PATERNAL PARENT: Is that Dorothy? I can't see her face from this distance.

MATERNAL PARENT: Neither can I. I recognize her knees. though.—*Judge.*

Mr. Henpeck—"I am thinking of taking a cottage hereabouts."

Farmer—"But don't you think the climate would disagree with your wife?"

Mr. Henpeck—"Disagree!—it wouldn't dare."—*Pearson's Weekly.*

In the state of Minnesota
Ten thousand Jews
Peddle booze,
Without the state's permission,
To supply the needs
Of a million Swedes
Who voted Prohibition!

—*Coronado Strand.*

Airplanin'

Oh, there's thrills a-plenty
In ridin' in the sky.
And if you ask *me* should you go
I'll not tell you to be shy.

For the fellow who has plenty nerve
And no family to demure,
If he wants to take the gol-darned risk
Believe me I'll say "Sure."

It's worth a lot of money
And time to take a flight,
'Cause believe me, man, you get a thrill
And see a rare good sight.

But if you're not a free man
And got a wife and kid,
It isn't really worth your while,
You're apt to take a skid.

So if you're free, take my advice,
Go up and fly around,
But if you're not, you'd best think twice
Before you leave the ground.

—*Elizabeth Harrison.*

MOTHER: I saw Jack kiss you. I am terribly shocked! I did not imagine he would dare take such a liberty!

HERSELF: Neither did I. In fact ma, I bet him a pair of gloves he daren't!

JANE: Dearest, now we are married, I have a secret to tell you. My, my left eye is made of glass.

JOHN: Never mind honey. So are the diamonds in your engagement ring.

UNIVERSITY OF ILLINOIS LIBRARY
FEB 22 1922

AERIAL AGE WEEKLY

VOL. 14. No. 24 FEBRUARY 20, 1922 10 CENTS A COPY



A Remarkable Airscape of Bedloe's Island and the Statue of Liberty Photographed by the Fairchild Aerial Camera Corp.

Wanted: A Government Policy in the Purchasing of Aircraft Supplies

ED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
tions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

SPECIAL OPPORTUNITY

To Secure a Copy of the

Textbook of Aero Engines

By E. H. SHERBONDY and G. DOUGLAS WARDROP

Together With One Year's Subscription to

AERIAL AGE WEEKLY

The Leading Technical and Trade Aeronautic Publication in America

The Textbook of Aero Engines has been prepared for the purpose of having in one volume the complete information concerning all modern types of aero engines and an up-to-the minute discussion of the principles of aero engine design and construction, so that the reader may be able to undertake comparative research without recourse to a formidable list of volumes and publications, which in any event could only supply him with more or less obsolete information.

AERIAL AGE WEEKLY discusses and describes all current developments in the aero engine field, so that with the Textbook and consecutive copies of AERIAL AGE the subscriber will possess a complete encyclopedia on the subject.

To AERIAL AGE WEEKLY
280 Madison Ave., New York

Please send me a copy of the Textbook of Aero Engines (regular price $10.00), and enter my name on your subscription list for one year (regular price $4.00). I desire to take advantage of securing both at the special price of $10.00, and am enclosing my check for that amount herewith.

Name .....

Address .....

February 20, 1922

AERIAL AGE WEEKLY

VOL. XIV, No. 24

TABLE OF CONTENTS

Wanted: A Government Policy in the Purchasing of Aircraft Supplies 559
News of the Week 560
Calendar of Coming Events..... 560
The Aircraft Trade Review..... 561
Soaring Flight, Its Development and Prospects 562
The First Air Migration..... 564
Aerial Lighthouses 564
The Dead Weight of the Airship and the Number of Passengers That Can Be Carried..... 566
Standardization and Aerodynamics. 570
Naval and Military Aeronautics... 571
Foreign News 572
Soaring Flight 573
Aeronitis 574

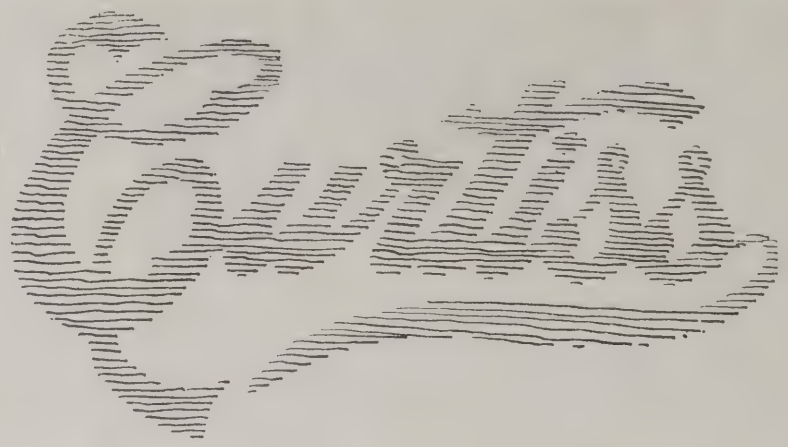
PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.
Printed in U. S. A.

Dealers wanted



DELIVERING a 3-place Lincoln Standard Tourabout to Messrs. Bell and Long of Kansas City, Mo., December 21st, 1921, at zero temperature. (Note the aluminum covering on lower half of the radiator.) On account of the extreme weather conditions their flying instruction was transferred to the Oklahoma City flying field.

Nebraska Aircraft Corporation
Lincoln, Nebraska



Announcing 1922 Price List

NEW PRODUCTION

	LIST PRICE
ORIOLE:	
With OX5 Motor	$3000.00 F.O.B. Buffalo, New York
With K-6 Motor (1919)	4400.00 F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	4800.00 F.O.B. Buffalo, New York
SEAGULL:	
1919 K-6 Motor, dual stick control	5200.00 F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	5600.00 F.O.B. Garden City, L. I.
STANDARD:	
With C-6 or K-6 Motor	3600.00 F.O.B. Garden City, L. I.
MOTORS:	
C-6 or K-6 (150 H.P.)	3000.00 F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

JN's:	
JN4D with new OX5 Motor	$2400.00 F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	$1200.00 to 2200.00 F.O.B. Dallas, Texas
STANDARDS:	
With new OX5 Motor	2000.00 F.O.B. Houston, Texas
With overhauled OX5 Motor	1700.00 F.O.B. Houston, Texas
Without motor, rebuilt for OX5	1100.00 F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	1600.00 F.O.B. Garden City, L. I.
Without motor, as received from Government	800.00 F.O.B. Houston, Texas
MOTORS:	
OX5 New	800.00 F.O.B. Various concentration fields
OX5 Overhauled	600.00 F.O.B. Various concentration fields
OX5 As received from Government	500.00 F.O.B. Various concentration fields

NOTE: Where delivery is made from other than F.O.B. points, accrued transportation charges must be added.

WRITE FOR DETAILS IF INTERESTED IN BECOMING A DISTRIBUTOR OR DEALER, STATING TERRITORY DESIRED.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., February 20, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, FEBRUARY 20, 1922 No. 24

WANTED: A GOVERNMENT POLICY IN THE PURCHASING OF AIRCRAFT SUPPLIES

THE Administration has shown many evidences during the past few months of a desire to thoroughly study the aircraft industrial situation, as recommended by the Advisory Committee on Aeronautics and by the President in two messages. But no steps have been taken towrads the appointment of a Board empowered to review the aircraft industry in an intelligent manner.

Since the war, the Army Air Service has purchased its material both on the proprietary basis and competitive engineering and competitive production bid basis without any very definite policy to take back its decisions.

The recent inquiry of the Air Service for either 25 to 50 Martin bombers and the resulting offers made by eight manufacturers brings this matter to the immediate attention of all those interested in American aircraft construction.

The company which put in the lowest bid and which is now operating on a most economical basis in its every branch, including engineering, was able to quote a price considerably lower than any other competitor. Some hesitation, however, has been shown by the War Department in the placing of the business with this company on account of the fact that other companies have not, for one reason or another, obtained sufficient business to maintain their organizations.

The question naturally arises, how far are the officials of the Government warranted in deviating from the established rule requiring the acceptance of the lowest qualified bidder, in order to maintain an industry composed as it should be of a number of industrial units, and further, how many such units can be expected to be sustained by the Government pending the development of a commercial demand. It is almost axiomatic that the development of this art can only come through the healthy competition of individual units. It is further quite clear that this competition should consist primarily of creative engineering, coupled with manufacturing ability, and that, therefore, these industrial units should be organized to meet this demand.

The production of aeroplanes in large quantities in America is not now necessary. The development of improved types on the other hand is of vital importance both from a military and civil standpoint. In case there should occur a quantity demand through war emergency, if the creative development has progressed satisfactorily and with it the practical engineering plans and models, these can be placed in industries other than those primarily aircraft producers to meet the emergency, as was done in the late war. The failure to produce at that time was caused principally by the lack of accepted types properly developed and the plans and engineering data to go with them for their prompt assimilation for war time production.

This condition is bound to recur unless the Government profits by lessons which can be drawn from recent experience.

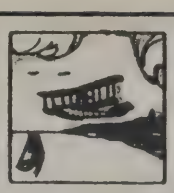
The necessity of a review of the aircraft industrial situation is obvious and the President's recommendations should be seriously considered by the Departments interested. A board made up of aircraft engineers in the two Services, together with their contracting officers and the best business representation to be had should be appointed at once by the President to make a thorough study and report. This board would doubtless consider the problem under heads something akin to the following:

1. The amount of appropriations probably available for:
   (a) The purchase of ships of new design.
   (b) Equipment in reasonable quantity for actual use in the existing Services.
2. Having reached an approximate amount to be spent, it should then consider the existing organizations under the following characteristics:
   Previous experience and the existing ability of each company to create practical aeroplanes and reduce them to successful production.
   Under this heading, five factors should be studied:
   (a) Personnel of the organization, and its physical equipment in laboratories and manufacturing facilities.
   (b) The financial resources of the company, its liabilities and its prospects of a permanent producer.

(*Concluded on page* 575)



THE NEWS OF THE WEEK



Plans for Big Air Fleet in San Francisco Approved

Plans for the reorganization of the army aviation forces at Crissy Field, the Presidio, San Francisco, into a large defensive unit for the protection of the entire coast of California have been approved by the war department and are now being carried out at an expenditure of more than $500,000, it was announced recently.

Twenty De Haviland Combat planes of the most modern type have been ordered immediately transferred to the field to replace old machines to augment the squadrons stationed there. Two of the planes arrived a few days ago from San Diego and the remainder are expected to be on the field before the end of the month.

The planes, which are valued at $9400 each, are to be equipped with wireless instruments in order that they may be in constant communication with aviation headquarters. Numbers of experienced wireless operators have reported for duty at Crissy Field to form part of the crews of the new aero fleet.

Two fully equipped radio trucks have been ordered transferred from Rockwell Field to the Presidio station. The trucks carry powerful radio instruments which will enable them to communicate with planes flying in all parts of the state.

The plan of the war department calls for the establishment of a skeleton aero fleet, the operations of which will extend to all parts of the state. In case of war the fleet would be augmented by groups of reserve squadrons which are to be equipped at Crissy Field. The Presidio will form the headquarters of the organization, from which various squadrons will operate.

As a squadron of planes flies from the field, fast motor trucks containing a complete wireless station, a photographic station and an entire squadron headquarters, will start off by land. Upon arrival at the destination, which may be any part of the coast of California, the squadron headquarters will be set up.

The planes will operate entirely from the field base, which will be as fully equipped for their control as the Crissy Field headquarters itself. The present plans call for establishment of two of these mobile bases.

Reserve squadrons will play an important part in the new system, it was announced. Observation squadron No. 440, reserve is now in process of organization at the Presidio.

New Invention in Aerial Photography

A recent invention by F. M. Huddleston, of Los Angeles, Calif., is creating considerable interest in aero-photographic circles. The Aerograph, as this invention is called, consists of a small pilot balloon from which is suspended a combination gyroscope and gumbal for holding the camera, together with electrical devices for controlling its operation. Absolute control is had from the base, which consists of a truck upon which is installed a winch and hydrogen generator, as well as a control board.

Chicago Air Service Reserve Officers Organized

Chicago is the headquarters of a group unit of air service reserve officers, powerful enough at full strength to bomb and gas a city of half a million persons out of existence in something less than two hours. So, at least, is the assertion of ranking officers in the new unit.

Appointments made were the first to be made in any air service reserve unit in this corps area. They were hailed as marking an important step in the nation-wide work the Army is now doing in building up an organization which may be instantly mobilized in the event of war.

The plan of organization of this unit embodies the lessons learned by America in the World War, lessons which have been completely lost following other great conflicts in which this country has engaged.

Ranking officer of the Chicago group is Capt. Philip G. Kemp. Other officers are:

In the 311th Observation Squadron, Second Lieutenants Alfred H. Kratky, Thomas C. Corbett, W. K. McCracken, Reginald C. Kuhn, Charles B. Daggett, Bernard R. Garner, Richard E. Ailsworth, Dana R. Simpson, Clinton E. Pardridge, James R. Gibson, Otto W. Grafe, Ralph R. Arnheim, Benjamin H. Drollinger, John Groenier, Elmer W. Reitz, William S. Hedges, Waldo T. Johnson and Albert C. McCaleb.

In the 321st Balloon Company, First Lieutenants Dunlap C. Clark and William Seick, Jr., and Second Lieutenants William B. Gemmill, Fred L. Faulkner and Meyer Morton.

In the 307th Attack Group, headquarters, Capt. Charles A. Reid, First Lieutenant Francis H. Miller and Second Lieutenant Clement G. Geisler.

In the 337th Air Park (307th Attack Group) Second Lieutenants Louis M. Beitler, Alfred C. Carrier and William H. Wright.

In the 338th Air Park (308th Pursuit Group), Capt. Fred M. Byerly, First Lieutenants Ralph L. Shannon, Wilbur T. Emerson; Second Lieutenants Arthur E. Johnson, George C. Lorentz and Paul F. Barbian.

In the 423rd Pursuit Squadron, First Lieutenants John W. Schroeder, John H. Skonigg, Marcus D. Richards, Nelson D. Barnett, Eugene N. Bergland, Joseph S. Pliska and Arthur H. Stanton; Second Lieutenants Guy K. Rudd, Richard M. Beil, Samuel A. Blair, Ralph H. Hetzel, August W. Willisch, Frederick H. Chetlain, Will C. Seivert, Gene Fogle, Arthur E. Becker, William C. Bausch, George T. Condron, Francis D. Greene, Arthur M. Gullickson, William E. Rownes, Edward H. Gumbert and Edward W. Krueger.

In the 338th Air Park, First Lieutenants Henry T. Hemming and S. F. Norman, and Second Lieutenants Louis F. Mongrieg, Norman McKinney, Raymond R. Rehm and Robert C. Preble.

In the 311th Photo Section, Second Lieutenant James C. Keogh.

In the 407th Photo Section, Second Lieutenant Kenneth Dennett.

In the 309th Attack Group headquarters, Capt. Philip G. Kemp, First Lieutenant Joseph L. Whitney and Second Lieutenant Kent A. Alcorn.

In the 467th Attack Squadron, First Lieutenants Walter A. Stahl, Sidney J. Bovey, Robert C. Payton, Keith Jones and Herman H. Woeltjen; Second Lieutenants Cyril J. Goodman, Elsdon L. Maynard, Frank Stoll, Nicholas B. Clinch, Jr., George H. Pemberton, Sidney Levy, Norman E. Westfield, John L. Eddy, Andrew B. Bassi, Walter A. Bowers, Wilhelm A. Hansen, Marvin W. Thompson, Herbert C. Landsell, Robert C. Wilson, Walter Merker, Robert H. Matthews, Edwin H. Kinney, Joseph R. Orrico and James Wulpi.

In the 429th Photo Section, Second Lieutenant Leo Leonard.

In the 368th Balloon Company, First Lieutenant McDonald C. Lovell and Second Lieutenant Roger F. Howe.

In the 349th Air Park, First Lieutenant Leslie M. Parker.

CALENDAR OF COMING EVENTS
under sanction of
AERO CLUB OF AMERICA

April 30th (1 or 2 days)

Spring Show and Opening Meet

Place: Curtiss Field, Mineola, L. I., N. Y.
Conducted by: Curtiss Airplane & Motor Corporation, Garden City, L. I.

September 4th (about) 1-day meet for

Detroit Aerial Water Derby

Curtiss Marine Trophy
Class Race Prizes
Invitation Races
Speed Trophy

Place: Detroit River and Lake St. Clair.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

September 15th (about) 3-day meet

Pulitzer Trophy
Detroit Aerial Derby

for Aviation Country Club of Detroit Trophy and Liberty Engine Builders' Trophy and Class Race Prizes
Invitation Races

Detroit News Aerial Mail Trophy

for Multimotored Aeroplanes Speed Trials
Place: Mt. Clemons Field, Detroit, Mich.
Conducted by: Detroit Aviation Society, 4612 Woodward Ave., Detroit, Mich.

August 15th (about)

In Preparation by the Aero Club of America

American Elimination Trials, if Necessary for La Coupe Deutsch de la Meurthe (Race to be held in France about October 1st. Place: Mitchel Field, Mineola, L. I., N. Y.

September 30th

First Annual Interservice Championship Meet

Open to the personnel of
The U. S. Army, Navy and Marine Corps Air Service
Championships in Single Seater Fighting Bombing Reconnaissance Races Photography Races Formation Flying, Etc.
Location: Mitchel Field, L. I., N. Y.

August 1st (about)

Foreign Events

Coupe Jacques Schneider
Contest for Flying Boats and Seaplanes
Place: Italy (probably Venice).
Conducted by: Aero Club d'Itali, 24 Via Tor de'Specchi, Rome.
American entries received by the Aero Club of America.

October 1st (about)

Coupe Henry Deutsche De La Meurthe Race for Aeroplanes
Place: France.
Conducted by: Aero Club of France, 35 Rue François-1, Paris.
American entries received by the Aero Club of America.

The AIRCRAFT TRADE REVIEW

German Aviation to Revive in May

German aviation will celebrate its revival May 5, it was officially announced by the Government. This recalls the ultimatum that came from London May 5 last year, which provided that Germany's commercial flying industry might recommence activity three months after the Interallied Air Control Commission recognized that the provisions of paragraph 202 of the Versailles Treaty, concerning the surrender of all military flying machines and implements of aerial warfare, had been fulfilled by Germany. It is announced that the Conference of Ambassadors has decided that this provision of London's ultimatum has been complied with and that the three months period began February 5.

After May 5, 1922, therefore, the production and importation of flying material in Germany will be admissible. It is pointed out, however, that even after this date the Allied Governments shall prescribe to Germany certain rules concerning aeroplane building, so as to avoid the possible utilization of aircraft for military purposes. The Interallied Military Control Commission for Aviation, which is under the command of Gen. Easterman, will be dissolved in May.

In German industrial circles quick developments in the country's flying industry are predicted. The leading figures of the industry refer to the great number of experts who have been idle, owing to the provisions of the peace treaty, but who will be free to act in the spring.

Plan Aerial Mail to Chicago

Announcement was made that on a call issued by E. P. Brinegar, Chairman of the committee, twenty-five financiers, transportation men and aeronautical authorities will meet at luncheon in the Hotel Biltmore February 16 and discuss feasibility of an air mail and merchandise service between New York and Chicago.

The meeting will be addressd by R. E. M. Cowie, Vice-President of the American Railway Express Company; Col. John A. Jordan, former Chief of Construction of the Air Mail Service; Major Charles J. Glidden, W. G. Clark and others.

The Air Board of the Canadian Government will be represented.

R-38 Tragedy Due to Copying Models

Failure to take advantage of lessons learned by the model experiments in airship design will be given as the chief cause for the disaster of the R-38 in the report of the technical committee on investigation which is about to be published. Experts believe they now know the truth why the airship broke and conclude it wasn't surprising it did break and that it was only through luck that other airships in that class did not.

In the first place the original Admiralty specifications could not be carried out exactly because the size of the hangar available made it necessary to build a smaller ship by a few feet. This in turn, it is explained, caused proportionately frailer building because the Admiralty desired a ship capable of better performance than the Zeppelins were capable of. The margin of safety appeared ample, but during the construction of certain models experiments were made which threw doubt on the strength of the ship.

It had not been definitely ascertained if the results obtained with the models could be applied to a full sized ship, and the National Physical Laboratory was engaged in comparing the results of the models with those obtained in existing rigid airships when the Air Ministry forced it to curtail the work because of an economy decision.

All that could be done then was to work out results with models and apply them to the class that had done successful flying. So the R-29 was chosen. The result of these calculations, judging by the experiments with the model, showed the R-29 should have broken in the air. But on the contrary she rendered excellent service. It was therefore concluded the model experiments were not a reliable guide and should not be applied to the R-38.

But it is found now that the models are reliable and had this been definitely known at the time of the R-38 disaster should have been avoided. Why didn't the R-29 break? Simply because the designer, being comparatively new at the work, allowed an ample margin of safety, the experts say, and wherever there was doubt at any point he put in extra material to make certain. The result was that the airship was stronger than the specifications called for and also heavier than it was thought that it needed to be. This chance judgment during the construction prevented the breaking as the models indicated it should. But the R-38 builders followed the specification figures.

Field at Great Bend, Kansas

The Spencer Northrop flying field has been established at Great Bend, Kansas, where gas, oil, water and repairs can be secured by cross-country pilots. A charge of $1.00 is made for landing on the field by the operating company.

Air Service Mechanics School in Full Swing

At the present time there are 257 students entered in the various courses of the Air Service Mechanics School at Chanute Field, Rantoul, Ill. The majority of these men were enlisted in the recent recruiting campaign. A total of 511 men are now awaiting instruction, and within a week sixty of these will be placed in school. The remainder will be undergoing instruction within four months.

There are now two foreign officers attached to the school for instruction, viz: Lieut. Guillermo C. Friele of the Army of Ecuador and Lieut. Guillermo Martull of the Army of Cuba. First Lieut. Henry Cooper Zuniga, Air Service, Army of Chile, was graduated from the Officers' course in Engine and Plane Maintenance on January 13, 1922. He is to return to Chile shortly. Lieut. Zuniga has been at Chanute Field for the past four months and has made many army friends during that time.

Personal Par

Commander Lee Hammond, veteran aviator, has joined the staff of Harry T. Hollingshead, whom he will assist in the distribution of LaFayette motor cars in Chicago and vicinity. Thousands of automotive experts who served in the United States Navy during the war, will remember Hammond as the commanding officer of all naval aviation schools, which were assembled at Great Lakes early in 1918. Under his direction, more than 15,000 bluejackets and officers were given intensive training in Liberty motor work, rigging, aerial gunnery, aerial navigation and kindred subjects. On detached duty from Great Lakes Commander Hammond served as aviation officer at the 1919 fleet rendezvous at Guantanamo, where he conducted experiments in flying small planes from the deck of a dreadnaught.

Aerial Lighthouses

(*Concluded from page* 565)

by a hexagonal lantern. On the top of the latter is another hexagonal plate carrying a second and similar burner surrounded by a half-lens composed of 6 dioptric elements, all enclosed in a cone-shaped lantern.

The rotating device carries a cam which controls by a lever the cock on the valve so as to give instantaneous closing and opening, thus producing successive periods of illumination and extinction—according to the type of cam fitted—of both burners simultaneously. Two by-passes of a special type are fitted to each burner, giving instantaneous relighting of the burners. The clockwork device is very strong, and is powerful enough to actuate the light all night without rewinding. A movable stand at the side of the tripod carries two or more bottles of dissolved acetylene (4,000 litres each) for supplying the burners.

As previously noted, the clockwork device can be replaced by a gas motor or by an electric motor (when electrically lit). These motors carry the cam, and their installation eleminates the necessity of daily winding the clockwork. The automatic lighting and extinguishing device, previously described, may also be fitted. The total weight of this light, without the gas bottles, is about 825 lbs.

SOARING FLIGHT, ITS DEVELOPMENT AND PROSPECTS

By WM. KNIGHT, M. E.

RIGHT after the war, aeronautics found a new field of activity in the use of gliders, which, because of their light weight, due to the absence of a motor and other heavy parts entering into the design of an aeroplane, made it possible to utilize air currents for making soaring flights.

German aeronautical engineers, who, on account of limitations imposed on the activities of aeronautics in Germany after the Armistice, found that the treaty of Versailles, temporarily prevented them from flying on any sort of a motor-propelled flying machine. With the typical German knack for quickly devising and adopting substitutes, they took to soaring flights on specially designed gliders imitating the hovering of large birds in the air.

This new field of activity of aeronautics is very interesting indeed, not only as a fascinating new sport, but also on account of the possibilities that it affords in connection with future developments of aeroplane design.

In 1920 a soaring flight competition took place in the Rhoen Valley and various gliders were entered. The winner of that contest was an apparatus designed by Klemperer of the Aerodynamic laboratory of the Aachen Technical Institute, which was entered in the competition by the aeronautical union of Aachen (Aix-la-Chappelle). This machine, piloted by Klemperer himself, made a 2½-minute, non-stop flight covering a distance of 6,000 feet.

The gratifying results obtained at the first Rhoen competition gave sufficient encouragement to other designers to further develop this new type of aircraft, and at the second Rhoen competition, in 1921, more than 40 machines were entered. There were so-called "suspension gliders," others resembling the war scouting aeroplanes, others with flapping wings, and others with movable supporting planes (system v Loessl).

The results obtained at the second Rhoen competition were very important; flights of more than five minutes' duration, covering a ditance of between 10,000 and 13,000 feet, were made by Klemperer on the Aachen machine; by Koller on the von Loessl machine, and by Martens on the Hanover machine. All of the pilots succeeded in rounding curves as well as closed circles. The sensation of the day, however, was created by the straight flight accomplished by Klemperer over a pre-arranged route from Wasserkuppe to Gersfeld in thirteen minutes, rising at the height of about 300 feet and remaining still in the air at that height, after making a ten minutes' straight flight.

This flight beat the three minutes world record of Orville Wright and inaugurated a series of longer flights of 15 to 21 minutes' duration accomplished some time later by Martens and Harth.

It is out of the question that these results are to represent, at all, the maximum that can be expected from this new type of aircraft, and it is probably safe to predict that flights of one hour or more duration will be accomplished in the future, as this new type of aircraft is further perfected.

A great deal of interest is now being evidenced in soaring flights in the United States, Spain, France, England and Sweden. The possibilities of utilizing, through personal skill, air currents and squalls and of being able to hover and soar in a noiseless flight over hills and valleys has made, in a short time, in Germany, at least, a large number of pilots enthusiastic about this new kind of flying.

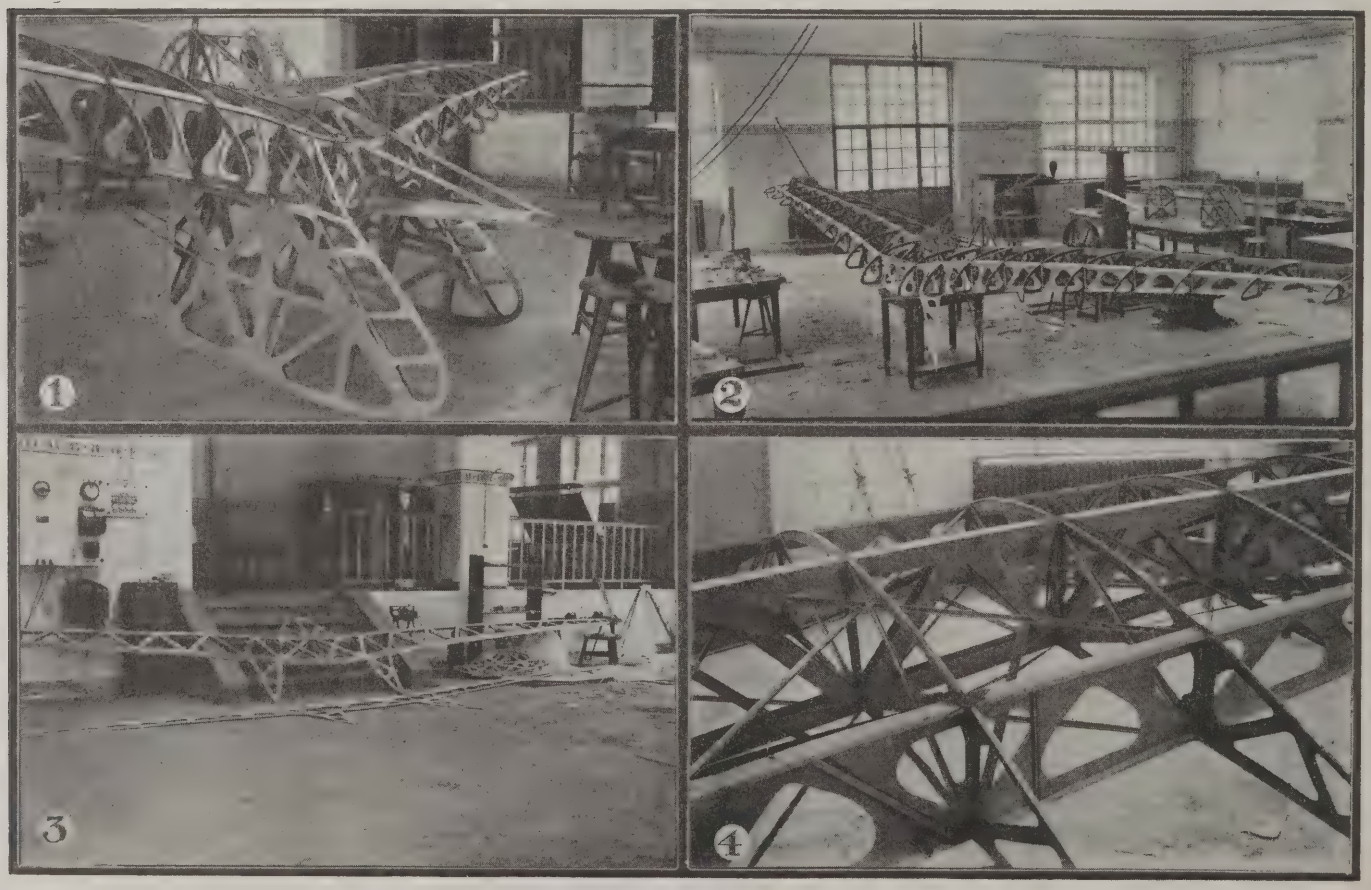
The Klemperer Machine

In designing this machine, the guiding consideration was that even for a motorless aircraft the most advantageous relation must exist between lifting force and head resistance; this being even more important than the reduction in the specific load of the carrying surface. Also it was deemed to be of primary importance to obtain a great efficiency in steering, accompanied by a sufficient static stability.

On account of these requirements, a rigid beam construction monoplane type was adopted. The number of such parts which do not bear any load, but simply concur in increasing the head resistance, was reduced to a minimum. All such parts which could not be eliminated in the design were covered by a streamline covering. The material used in this construction is almost entirely wood and fabric covering. Bracing wires have been entirely eliminated in the construction of this machine.

The lifting surface consists of one continuous wing which is built on three longitudinal beams, the middle one of them having a factor of safety of five, even if the entire load was taken up by that beam only.

Figures 1, 2, 3 and 4 will give details of construction of the



Figs. 1, 2, 3, 4, details of construction of the Klemperer Glider

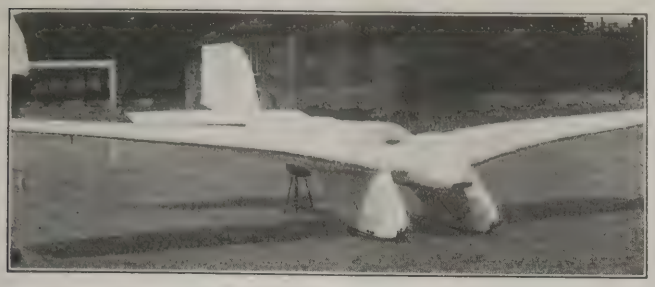


Fig. 5. The Klemperer Glider.

wing and the skid undercarriage, which, as can be seen from the illustration, is built integral with the wing.

Figure 5 shows the glider on the ground. The tail of this glider can be detached from the wing, this having been done in order to facilitate the shipment of the machine from one place to another.

The total weight of the first glider entered at the Rhoen competition was 60 kilograms. The tail only weighed 11 kilograms. The latest type entered in the 1921 competition weighed 56 kilograms. This machine is started by dragging it by hand over the ground with india-rubber stays attached to some hooks fixed to the back ends of the skids, which are fitted all around with rubber cushions. The entire machine is covered with fabric and the head resistance is reduced to a minimum due to the good stream-line shape of the body and wings. The machine is able to rise in the air with a minimum wind velocity of four meters per second.

Figure 6 shows the machine on the ground ready to start to fly.

Figure 7 shows the machine in the air.

Table 1 gives the performance of this machine at the 1920 and the 1921 Rhoen competition.

Sb-2-von Loessl Glider

A machine of this type was entered in the Rhoen competition by the Bavarian Aero Club of Munich, and proved to have some very good gliding properties and a great facility in steering. The world record of the maximum distance covered in the minimum time was established by this machine in one flight when it covered a distance of 13,000 feet in five minutes.

The von Loessl glider resembles in the general lines the Grades' High plane construction, but is equipped with two separate wings twisting around a main beam, each of them being highly resistent to torsion. Altitude steering is obtained by twisting the *total* surface around the beam, whereas the steering gear, consisting of one horizontal steadying surface, is fixed. Owing to this kind of steering, sudden squalls can, due to the small inertia of the wings, be more quickly avoided or utilized, as the case might be, than with normal altitude steering. Horizontal and vertical steering is obtained through a triangular lever and two coupling rods. The steering gear does not differ from the usual one. The improvement which offers the Aachen type, sb-2 over the 1921 type of the Bavarian Aero Club consists of a more favorable location of the wing beam, which makes steering more easy for the pilot to accomplish, and also upon the more simplified method of construction in which tubular steel frame is used, and in the decrease of head resistance.

Figure 8 shows the machine in flight, and Table 2 gives the performance of this machine at the 1921 Rhoen competition.

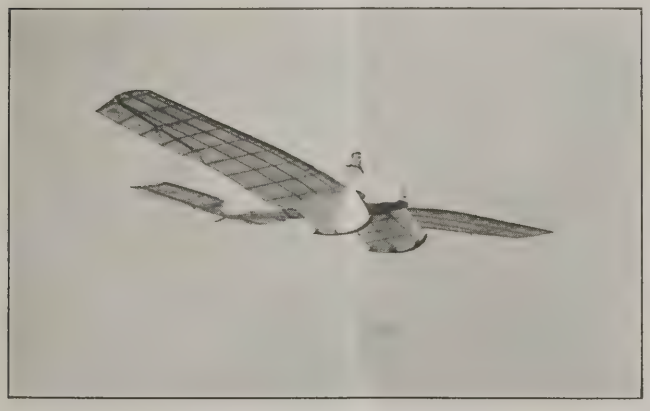


Fig. 7. The Klemperer in the air



Fig. 6. The Klemperer about to start

Table 1

Flights made with Klemperer's machine

1920

Nr.	*Distance*	*Time*
1	300 m.	35 sec.
2	400 m.	40 sec.
3	1830 m.	143 sec.
4	221 m.	75 sec.

(First soaring flight.)

1921

Nr.	*Distance*	*Time*
1	170 m.	26 sec.
2	310 m.	40 sec.
3	295 m.	30 sec.
4	280 m.	34 sec.
5	210 m.	34 sec.
6	380 m.	61 sec.
7	1800 m.	242 sec.
8	600 m.	275 sec.
9	30 m.	32 sec.
10	2800 m.	245 sec.
11	2100 m.	331 sec.
12	350 m.	78 sec.
13	400 m.	130 sec.
14	4600 m.	783 sec.

(Last flight from Wasserkuppe to Gersfeld.)

Table 2

Flights made with von Loessl machine

Nr.	*Distance*	*Time*
1	390 m.	34 sec.
2	805 m.	75 sec.
3	900 m.	81 sec.
4	160 m.	17½ sec.
5	130 m.	25 sec.
6	460 m.	55 sec.
7	300 m.	46 sec.
8	975 m.	97 sec.
9	1900 m.	169 sec.
10	825 m.	89 sec.
11	755 m.	102 sec.
12	1685 m.	130 sec.
13	625 m.	80 sec.
14	735 m.	89 sec.
15	4080 m.	305 sec.

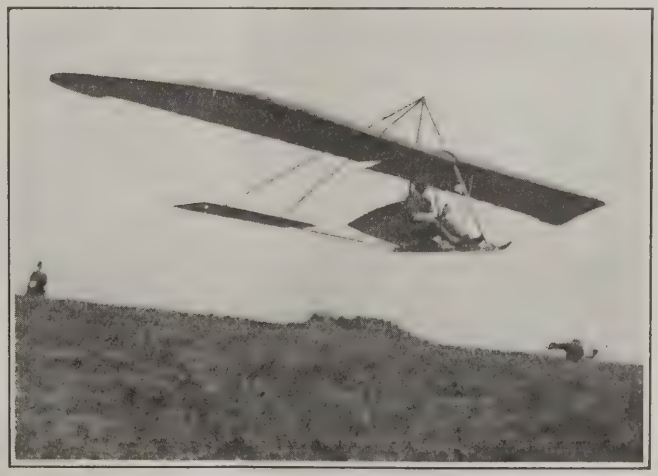


Fig. 8. The von Loessl Glider

THE FIRST AIR MIGRATION

By W. WALLACE KELLETT

TOWARD the latter part of the afternoon of November 3, 1921, some forty-five thousand people, spectators on the fourth and last day of the American Legion Flying Meet, slowly started wending home on their different ways from the great aerodrome seven miles from the heart of Kansas City, Mo.

This great throng had been in the gathering, as it were, all that day. From early morning till mid-afternoon, a continual stream of arrivals found points of vantage around the great field. So well handled, so efficiently distributed were they, that one hardly realized their immense number as they slowly increased. But when the last event had finished, when the aeroplanes lazily droning overhead were no longer in competition or on exhibition, then, as the forty-five thousand moved almost with one accord toward the roads, the congestion and confusion common to every such gathering at once became apparent.

Viewed from any of the areoplanes which circled and soared above them, the vast crowds looked exactly like an army of ants, slowly swarming over every road, even overflowing into adjoining fields in efforts to escape the general crush.

But the real aviation fan, lingering behind at the paddock where the seventy-odd aeroplanes which had taken part in the four days flying were neatly parked, was well paid for his interest. Along the entire paddock also there was confusion. Planes were being gassed up, motors tested, mechanics and pilots moved busily about. If Mr. Interested Onlooker chanced to inquire the cause of all this bustle and activity, he was quickly informed by any of the hustling mechanics: "We're pushing-off for Omaha."

Omaha, incidentally is 200 miles north from Kansas City. At Omaha the Pulitzer Trophy Race and Flying Meet was to be held on the following day, and very few of the Kansas City fliers intended to miss it. They "hopped off," singly, or more often two or three together, and after circling over the field, waving a farewell to hospitable Kansas City, headed due north and soon were lost to sight in the clear blue sky.

"See you for dinner at the Fontenelle" was the most frequent parting salutation among the fliers, and these words, spoken with the sun already well on its way down toward the western horizon, binding an engagement 200 miles away within the next two or three hours, aroused in the lingering aviation fan, for such indeed was the aforementioned onlooker, a feeling of pride, of wonder, of happiness mingled perhaps with longing—in all, a greater thrill than all the sensational flying of the four-day meet had been able to give him. Longing, because he was not destined to wing away that beautiful fall evening with the rest, but the other—the thrill of realization, because, did he not see with his own eyes, ordinary men calmly packing up and taking to the air to reach their destination, 200 miles away, as though it was the most natural thing in the world? And in the minds of these travelers, it was not the flight, but the dinner at the Fontenelle that was uppermost.



W. Wallace Kellett

Truly, the first real civilian air migration in the world commenced that cool, clear evening at Kansas City. By eleven o'clock the following morning some fifty-odd commercial and pleasure aeroplanes, each and every one fully loaded, had "pushed off" as the fliers put it, for Omaha, and by two o'clock, the same afternoon, every machine, even the slowest and tardiest of them, was peacefully at Ak-sar-ben Field, Omaha, and the passengers were comfortably seated ready for the start of the Pulitzer Trophy Race.

A few of the machines which left Kansas City were single seaters and there were also several large and comfortable cabin liners, carrying eight, but the great majority carried two persons and their baggage. Easily one hundred people migrated to Omaha. Literally migrated, for their five-day residence in Kansas City was quickly transferred to Omaha for an equal period.

The fifty-odd machines carrying them flew a total distance of some 10,000 miles on this trip, and not an accident of any kind! And neither pilots nor machines had been subjected to any inspection or examination whatever for proficiency or reliability.

The average time for the flight from Kansas City to Omaha was 2½ hours, compared with seven or eight hours by the fast trains. And to those who took part in this first air migration in history, the whole affair seemed so natural that it was scarcely noticed—in fact was entirely forgotten a few minutes after arrival, when new and interesting sights occupied the attention of all.

Only to our friend, the lingering onlooker, watching these ships of the air gracefully leaving the airport at Kansas City for the last time, was the true significance and meaning of the whole performance truly brought home.

But to those who are actively interested in Aeronautics, who realize that flying is of the present, rather than the future, having witnessed barrier after barrier of opposition, bred by ignorance and prejudice, give way before the marvelous performances accomplished within the last few months, the success of this first air-migration brings new courage and a greater certainty that their fondest hopes are now being realized.

From fifty machines the number will soon increase to one hundred, then two hundred, carrying four or five hundred passengers rapidly and safely from one great city to another. This will doubtless happen within the next twelve months. Beyond that, no one can safely prophesy the limits of the air.

AERIAL LIGHTHOUSES

We are able this week to give some brief particulars of the interesting aerial lighthouse that is being erected at Dijon in order to provide a suitable guiding light for the aerial routes between Paris and Algiers, Italy and Switzerland. This light, which is the largest and most powerful one in existence, was made by the famous French optical firm of Barbier, Bernard and Turenne of Paris, whose British representative is Major J. P. Ashley Waller of Audrey House, Ely Place, London, E. C. 1.

The range of this light in normal northern weather conditions will be about 65 miles, and in clear weather will be not less than 130, and more probably about 200 miles at a height of 6,000 ft. or thereabouts. The source of illumination is from powerful arcs, automatically adjusted and formed between horizontal carbons, which are surrounded by eight lenses, each composed of seven dioptric (refracting) and ten catadioptric (refracting and reflecting) parts. These lenses are so arranged that they divide into two groups of four, the axes of the two groups being opposed, and the beams from each group converge to form one large beam. This arrangement of lenses will be seen from the accompanying diagram. A special point to be noted is that the lenses are split vertically at the centre. This splitting is a patented device of the designers to enable the beam of light to take a greater speed vertically than horizontally, in order that the light may be visible outside and above the main beam. The arcs and lenses are carried on two platforms, two lenses of each group being on the top platform and the remaining pairs on the second. Below these platforms is a third, carrying a set of stand-by lamps together with the necessary apparatus for bringing these into action and focus when required.

All three platforms are connected, and, together with all the mechanism, revolve on a vertical shaft to which they are keyed. This shaft is mounted on ball bearings and stepped in a cast-iron socket which rests on a concrete base. An electric motor with reduction gear is fitted under the lower platform and serves to revolve the whole.

Surrounding all the above is an 18-ft.

diameter "house," the upper portion, opposite the lights, consisting of a double tier ventilated lantern; inner and outer galleries, with ladders, are provided for the crew. All the controls are fitted on the lower platform, whence every lamp can be inspected by means of special reflecting prisms, and its focus adjusted.

This particular light is intended for the present to give flashes at regular intervals, but, as it might be necessary to change this later on and to provide intermittent flashing of irregular periods, cams have been fitted which can be brought into play at any time to vary the length of flash and the intervals between flashes. The electric arc has been selected by the French Government for this Dijon light, as the necessary current is available in this case, but filament lamps could equally well have been fitted, with a considerable reduction in current consumption for the same intensity of light.

Powerful as this light is, we understand that the makers have full designs prepared for lights of even greater range, such as would be necessary for lighting desert routes when the number of lights employed should be kept down to a minimum. Where electric current is not available, as in the above case or Central Africa, etc., either acetylene gas or paraffin vapor would form the source of illumination, whilst automatic devices would be fitted which enable the lights to operate unattended over periods of many months.

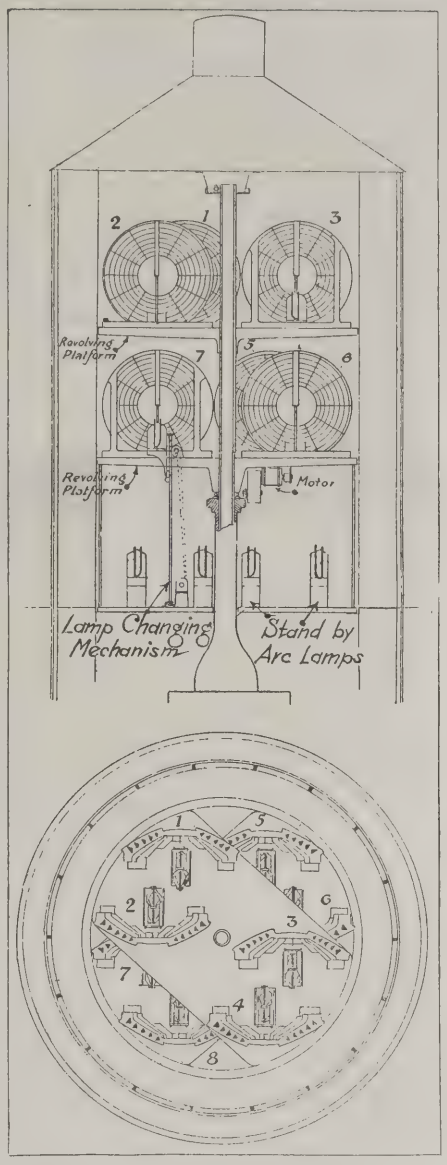
This automatic device, which is fitted on many marine lights erected all over the world by Messrs. Barbier, Bernard and Turenne, automatically lights and extinguishes the lamp at any predetermined times, and is operated by the combined action of a clockwork motor and the flow of gas leading to the by-pass—or an electrical device where electric light is employed.

The whole gear is extremely ingenious, but lack of space will not, at present, permit a full description here. Briefly, however, it is composed of a clockwork movement with anchor release carrying a timing-box and timing disc divided into 24 hours, the last making one revolution per day. The timing disc carries two ciruclar slots which engage two levers suitably disposed which open and close a valve controlling the gas supply. Winding of the spring is effected by a gas motor driven by the gas leading to the by-pass and working a ratchet driving the drum containing the spring. A gas pocket regulates the pressure and feed to the by-pass.

Gas from the main supply enters a valve leading to the burners, thence to the gas motor. The latter consists of a box containing a membrane, which is raised by the pressure of the gas, and in so doing operates a ratchet gear, which in turn winds the spring drum—a friction slipping device being, of course, provided.

From the motor the gas passes to the gas pocket which, through the medium of an arrangement of membranes and springs, feeds the by-pass, with a constant supply of gas. The opening and shutting of the valve is effected by the movement of adjustable keys fitted on the timing disc between the arms of the lever which controls the valve—the timing disc being, of course, driven by the clockwork motor.

During the Great War Messrs. Barbier, Bernard and Turenne carried out a considerable amount of work in connection with aerial guiding, landing and other lights, and as a result of the experience thus gained have produced a number of standard patterns of aerial beacons, etc. Amongst these brief mention may be made of two, one a special medium-range flashing light of the fifth order, and the other a portable flashing light of the fourth order, which is shown in the accompanying illustration.



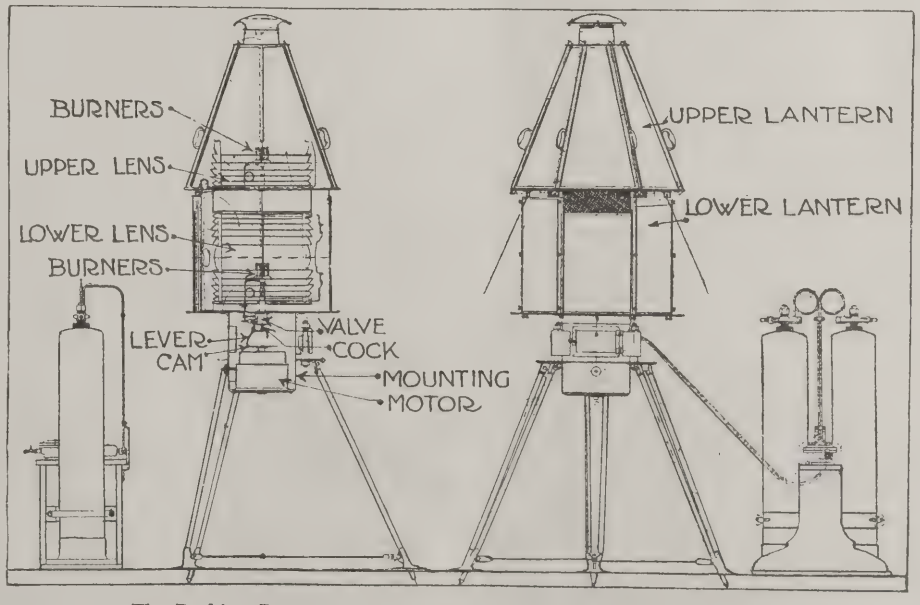
Elevation and plan diagrams of the Dijon light, showing the arrangement of the eight lenses and arcs into two groups on two revolving platforms

The former light has an optic composed of five annular panels, disposed in pentagon, which permits the following signals being given: (*a*) 1 flash, (*b*) 1 group of 2 flashes, (*c*) 1 group of 3 flashes, (*d*) 1 flash followed by a 2-flash group, (*e*) 1 group of 4 flashes. For these different combinations metal panels are employed to mask the appropriate lenses. Each annular panel is composed of three dioptric, five upper catadioptric and three lower catadioptric rings. The optic is arranged to give a beam of light whose axis, allowing for atmospheric refraction, at the limit of range crosses the 13,000 ft. altitude, and in order to give visibility right up to the zenith, the panels are split on their middle vertical line as previously described.

The source of light may be either electric or acetylene, or an adaption to take either at will. If electric, a 3,000-c.p. metal filament lamp is used, absorbing 15 amps. at 110 volts. For acetylene, either a 12-burner naked-flame light (300 litres/hr.) may be used or an incandescent burner. The support for the burner is adjustable for focussing, and a sight tube enables the latter to be accomplished whilst the light is burning. Rotation is effected in three different ways: (1) If electrically lit, by an electric motor coupled direct to a reduction gear, all on one base plate. (2) If lit by acetylene, by weights and gearings. (3) If for alternate lighting, the base of the light takes both electric motor and weights, a clutch system being fitted to transfer from one to the other. The optic, its base and the rotating gear are all enclosed in a lantern having a metal lower part with doors for access to the gear; the top is fitted with glass and is ventilated.

The fourth order light is especially suitable for military work, or for marking out temporary air routes. It consists of a tripod supporting a mounting in which is fitted a clockwork rotating device (or gas motor or electric motor). The upper part of this mounting also carries, on a circular plate, the valve and adjustable holder for the burners (12-burner, 30 litre/hr. type). Covering the whole mounting is a hexagonal plate on which is fitted the lens, composed of 11 dioptric elements, enclosed

(*Continued on page* 561)



The Barbier, Bernard and Turenne Portable Flashing Aerial Beacon

THE DEAD WEIGHT OF THE AIRSHIP AND THE NUMBER OF PASSENGERS THAT CAN BE CARRIED*

By COLONEL CROCCO

Formula for Obtaining Weight of Dead Load

IN order to determine an approximate formula giving the weight of the dead load in function of the volume V of the envelope and of the maximum velocity v, we will take the relative weight of the various parts of the airships P^v, M, V, A, $T^{3\,4}$, adopting a mean value of the coefficients determined.

This formula may be adopted both for semi-rigid airships with suspended nacelle and non-rigid envelope, with or without internal suspensions, and to airships with rigid longitudinal beam, with power units on external supports or in nacelles, and with non-rigid envelopes, with or without internal bracing cables.

Weight of the Envelope

The envelope consists of various parts:

1st. Rubber on the outer reinforced part (about 0.200 kg. per square meter); its weight is proportional to the surface, ($V^{2/3}$).

2nd. Fabric of the outer reinforced parts; its weight is proportional to the surface ($V^{2/3}$) and to the tension, which increases according to the pressure ($V^{1/3}$) and the diameter ($V^{1/3}$). Therefore the weight of the fabric increases as

$$V^{2/3}\ V^{1/3}\ V^{1/3} = V^{4/3}$$

3rd. The inside portion of the reinforced part (internal bracing cables) proportional to the volume V.

4th. The diaphragms and butts proportional to their number n, and to the surface ($V^{2/3}$).

5th. Interior ballonet on beam, tubes, etc., proportional to the surface area ($V^{2/3}$).

N. B. For all the envelopes enumerated below, the volume of the balloonet = 0.5 of the envelope.

Airships	Volume	Rubber Outer Reinforced Part		Fabric Outer Reinforced Part	
	cu. m.	Weight kg.	Coefficients	Weight kg.	Coefficients
M	12100	705	$1.34\ V^{2/3}$	303	$0.00290\ V^{4/3}$
A	18000	975	$1.41\ V^{2/3}$	1060	$0.00226\ V^{4/3}$
$T^{3/4}$	36000	1550	$1.42\ V^{2/3}$	2700	$0.00227\ V^{4/3}$
Mean Coefficient			$1.39\ V^{2/3}$		$0.00227\ V^{4/3}$

Airships	Internal Bracing Cables		Diaphragms and Butts		Inner Ballonet on Beam, Tubes, etc.	
	Weight kg.	Coefficients	Weight kg.	Coefficients	Weight kg.	
M^A	160	$0.0132\ V$	300	$0.114\ n\ V^{2/3}$	600	$1.14\ V^{2/3}$
A	290	$0.0161\ V$	830	$0.112\ n\ V^{2/3}$	770	$1.12\ V^{2/3}$
$T^{3/4}$	585	$0.0162\ V$	1300	$0.120\ n\ V^{2/3}$	890	$0.90\ V^{2/3}$
Mean Coefficient		$0.0152\ V$		$0.115\ n\ V^{2/3}$		$1.09\ V^{2/3}$

When the volume of the ballonet = 0.5 that of the envelope, the mean weight of the envelope is given by:

$$1.39\ V^{2/3} + 0.00227\ V^{4/3} + 0.0152\ V + 0.115\ n\ V^{2/3} + 1.09\ V^{2/3}$$
$$= 0.0152\ V + (0.115\ n + 2.48)\ V^{2/3} + 0.00227\ V^{4/3}$$

Weight of Gas and Air Valves and Their Controls

This weight is proportional to the volume V of the envelope, and from the mean value taken for the various airships it comes out at:

$$0.01\ V$$

Weight of the Reinforced Armature

By reinforced armature we mean the whole of the parts which help in bearing the load given by

Volume — Weight of envelope and valves

or, the longitudinal beam, the nacelle suspensions with their brackets, the longitudinal girder, the reinforced sides of the nacelle and their suspension cables. The stresses in the beams of the armature are due partly to the bending moment and partly to shear, caused by the load carried: Volume—Weight of envelope and valves = V — I. The bending moment produces in the beam stresses proportional to the load (V — I) and to the length of the bays ($V^{1/3}$) and inversely proportional to the height of the armature ($V^{1/3}$): that is, in all, proportional to

$$(V - I)\ \frac{V^{1/3}}{V^{1/3}} = V - I.$$

Shearing stresses are produced:

1st. In the beams and their diagonals proportional to the load, the bay, and the height, as for bending moments, therefore proportional to V — I.

2nd. In the struts proportional to the load V — I.

Therefore the stresses, and with them the weight of the reinforced armature (longitudinal beam, suspensions, the reinforced part of the bow and nacelle suspensions, the reinforced part of the longitudinal girder, the reinforced sides of the nacelle and their suspension tubes) are proportional to the remainder of the load:

Volume—Weight of envelope and valves = V — I.

	Airships		
	M (heavy)	$T^{3\,4}$	V
Volume.....cu.m.	12000	36000	14650
Envelope and Valves.....kg.	2690	7350	3575
V - I..... "	9310	28650	11075
Reinforced Armature..... "	1210	3750	1460
Coefficient.....	0.130 (V-I)	0.131 (V-I)	0.132 (V-I)

Mean Coefficient = 0.131 x (V — I)

which may also be written:

$$0.131 \left\{ V - [0.01\ V + 0.0152\ V\ (0.115\ n + 2.48)\ V^{2/3} + 0.00227\ V^{4/3}] \right\}$$
$$= 0.131\ [0.9748\ V - (0.115\ n + 2.48)\ V^{2/3} - 0.00227\ V^{4/3}] =$$
$$= 0.1277\ V - (0.01306\ n + 0.323)\ V^{2/3} - 0.0002975\ V^{4/3}$$

Weight of the Stiffened Part of the Bow

The weight of this is proportional to the bending moments which it has to support. These moments depend on the length of the stiffened part proportional to $V^{1/3}$, to the pressure of the wind on the surface, and to the square of the velocity, that is, to $v^2V^{2/3}$.

From this it follows that the bending moments, and therefore the weight of the stiffened part are proportional to

$$V^{1/3}\ v^2\ V^{2/3} = v^2\ V$$

N. B.—While in the airships P, M, A, and V, the stiffened part is separate from the beam and therefore resists alone the external pressure, leaning on the envelope, in the airship T the stiffened part is incorporated with the beam on which it leans for resisting external pressure. In the $T^{3\,4}$ the weight indicated, 600 kg., is that of the cupola alone, as we cannet determine the weight of the beam which bears the resistance together with the stiffened part; the coefficient determined will therefore be less than the true one, and is not reckoned in determining the mean coefficient.

---

* In 1913, comparing the effect of increase of dimensions in aeroplanes, and airships, I demonstrated in a lecture given at the Congress of Civil Engineers, Rome ("The Catastrophe of the L.2 and the Future of Airships," Annals of the Society of Italian Engineers and Architects, No. 5, March 1, 1914) that there was a fairly approximate limit of gain for the aeroplane, and that though such a limit was a little more extended for the airship it nevertheless existed.

Some years later, after the War, in a publication of the British Air Ministry, there appeared similar calculations showing the advisability of increasing the cubature of airships, without setting any limit to such increase. Wishing therefore to find a complete and practical solution of the problem by means of strict numerical calculations, we confided such calculations to Signor Primo Cellini, who from the very first, has made the computations for our airships. The result shows that there is an OPTIMUM value of the ratio between the useful load and the total load at about 270,000 cubic meters, and that practically the increase of cubature beyond this limit and even up to it, hardly compensates for the greater commercial risk incurred by the concentration of tonnage.

Extract from the Transactions of the Aeronautical Experimental Institute, Rome, Italy (September, 1920).

	Airships		
	P^V	M_A	V
Volume.....cu.m.	5000	12100	15000
Speed.....km/h	86	76	82
Weight of stiffened part of bow, kg.	66	120	180
Coefficient.....	0.0000232 v^2 V	0.0000225 v^2 V	0.0000230 v^2 V

	Airships	
	A	T^{34}
Volume.....cu.m.	18000	36000
Speed.....km/h	83	120
Weight of stiffened part of bow.....	215	600
Coefficient.....	0.0000225 v^2 V	0.0000150 v^2 V

Mean coefficient for P^V, M^A, V, A:
0.00002273 v^2V (v = speed in m/sec.)

Weight of Empennage

The rotating couples of the empennage are proportional to the volume V and are equal to the product of the forces and their distance from the baricenter of the envelope. As the distances are proportional to $V^{1/3}$, the forces and consequently the surfaces of the empennage, and also the weight of the empennage, are proportional to:

$$\frac{V}{V^{1/3}} = V^{2/3}$$

N. B.—In order to deduce a coefficient, we must abstract from the lower reinforced keel the weight of the part considered as being incorporated with the reinforced armature. The rest of the weight of the empennage we add to the weight of the upper, lateral keels. In the weight of the rudders is included only the weight of the planes and frames.

	Airships			
	P^V	M^A	A	T^{34}
Volume.....cu.m.	5,000	12,100	18,000	36,000
Weight of keels.....kg.	85	146	171	400
Coefficient.....	0.29 $V^{2/3}$	0.28 $V^{2/3}$	0.25 $V^{2/3}$	0.37 $V^{2/3}$
Weight of rudders.....kg.	185	340	460	600
Coefficient.....	0.63 $V^{2/3}$	0.65 $V^{2/3}$	0.67 $V^{2/3}$	0.55 $V^{2/3}$

Mean coefficient of keels = 0.62 $V^{2/3}$
Mean coefficient of rudders = 0.30 $V^{2/3}$

Weight of Engine Sets

In the engine sets, or power plant, are included: engines, radiators, tubes, water, oil, controls, propeller and longerons. Since head resistance varies according to the square of the speed and area ($v^2V^{2/3}$) and power according to v $v^2V^{2/3}$ = $v^3V^{2/3}$, the weight of the power plant will vary according to:

v^3 $V^{2/3}$

	Airships	
	P^V	M with wooden nacelle
Volume.....cu.m	5,000	12,100
Speed.....km/h	86	83
Power.....H.P.	420	630
Weight of Plant.....kg.	780	1170
Coefficient.....	0.000189 $v^3V^{2/3}$	0.000176 $v^3V^{2/3}$

	Airships	
	A	T^{34}
Volume.....cu.m.	18,000	36,000
Speed.....km/h	86	120
Power.....H.P.	1050	2700
Weight of Plant.....kg.	1950	4960
Coefficient.....	0.000200 $v^3V^{2/3}$	0.000123 $v^3V^{2/3}$

As the airships P^V, M, and A, have suspended nacelles and are similar in type, we may deduce from them the mean coefficient for their type:

0.000188 v^3 $V^{2/3}$ (v = speed per m/sec.)

while the T^{34}, a rigid type in which only the engine set juts out, is therefore more penetrating than the preceding and has a smaller coefficient:

0.000123 v^3 $V^{2/3}$ (v = speed per m/sec.)

If, instead, we wish to have a coefficient in function of H.P. only, and given that all the above-named airships have light engines (about 1 kg. per H.P.) with wooden propellers in direct transmission, the weight of the power plant will be about:

1,900 kg. per H.P.

Weight of Supports of Power Plant

By supports we mean: transversal bridges, external supports, engine nacelles and the part relating to the power plant only in mixed nacelles. The mean for the foregoing airships in function of H.P. gives

0.250 kg. per H.P.

Weight of the Pilot's Cabin

This may be taken as about proportional to the volume:

0.013 V

Weight of the Mooring Cables and Holding Devices

This may also be taken as proportional to the volume:

0.01 V

Total Weight of Dead Load

From the sum of the foregoing coefficients we have the following formula, which gives approximately the total weight of the dead load in kg.:

$$P = (0.1759 + 0.00002275\ v^2)\ V + (0.09994\ n + 3.075)\ V^{2/3} + + 0.0019725\ V^{4/3} + (\text{number H.P.})\ 2.150$$

N. B.—As we said at the beginning, such formulas are meant to be taken as approximations, for we cannot say definitely that, with increase of cubature, the weight of the various parts of the dead load will increase exactly according to the coefficients given. In the development of the details of each project various problems may arise, the solution of which may cause increase or decrease of the weight calculated by the formula. However, the values obtained by the formula are always good for a preliminary study.

Weight of Dead Load for Various Cubatures

In order to determine the weight of the dead load* for various cubatures, we will suppose that we have a profile of envelope with an aspect ratio of about 1/6, 10 diaphragms, and a maximum speed of 120 km/h. For the whole airship we will assume that the head resistance expressed in kg. is equal to:

$$R = 0.008\ S\ v^2$$

where v = speed per m/sec. and S the cross section in square meters at the point of greatest diameter. This section may be taken as

$$S = 0.318\ V^{2/6}$$

and we therefore have:

$$R = 0.00302\ V^{2/3}\ v^2$$

The useful power in kilogrammeters will be:

$$L = 0.00302\ V^{2/3}\ v^3$$

and the motive power in H.P. for a propeller efficiency = 0.7 will be:

$$HP = 0.0000576\ V^{2/3}\ v^3$$

With a maximum velocity of 120 km/h., the motive power in HP for the various cubatures will be:

Volume	Power in H.P.		Volume	Power in H.P.	
	Total	Per cu. m.		Total	Per cu. m.
50,000	2,900	0.0580	250,000	8,470	0.0338
100,000	4,600	0.0460	300,000	9,570	0.0319
150,000	6,020	0.0401	350,000	10,600	0.0303
200,000	7,300	0.0365	400,000	11,570	0.0289

and the weight of the dead load will be as follows:

* This determination is much influenced by the characteristics of the airship (maximum speed, coefficient of resistance, etc.). For the present, we shall confine ourselves to the study of a type having average characteristics.

Total and Unit Weight (per cubic meter) of the Envelope and Its Parts

10 Diaphragms. Volume of Ballonet = 0.5 that of the envelope.

Volume cu. m.	Outer Rubber		Outer Fabric (Reinforcing)		Internal Suspension (Reinforcing)		Diaphragms and Butts		Internal Ballonet on Beam, Tubes, etc.		Total Weight	
	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.
50,000	1,890	0.0378	4,200	0.0840	760	0.0152	1,565	0.0318	1,485	0.0297	9,900	0.1980
100,000	3,000	0.0300	10,600	0.1060	1,520	0.0251	2,485	0.0248	2,355	0.0235	19,960	0.1996
150,000	3,930	0.0262	18,120	0.1208	2,280	0.0152	3,250	0.0217	3,080	0.0205	30,660	0.2042
200,000	4,765	0.0238	26,620	0.1331	3,040	0.0152	3,940	0.0197	3,735	0.0186	42,100	0.2105
250,000	5,520	0.0221	35,780	0.1432	3,800	0.0152	4,565	0.0183	4,330	0.0173	53,995	0.2160
300,000	6,245	0.0208	45,750	0.1525	4,560	0.0152	5,165	0.0172	4,000	0.0163	66,620	0.2220
350,000	6,910	0.0197	56,100	0.1603	5,320	0.0152	5,715	0.0163	5,420	0.0155	79,465	0.2270
400,000	7,565	0.0189	67,200	0.1680	6,080	0.0152	6.260	0.0157	5,930	0.0148	93,035	0.2326

Total and Unit Weight (per cubic meter) of Dead Load

for a maximum velocity of 120 km/h. (33.3 m/sec.)

Volume cu. m.	Envelope with 10 Diaphr.		Gas and Air Valves and Controls		Reinforcing Armature		Stiffened Part of the Bow		Keels		Rudders	
	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.
50,000	9,900	0.1980	500	0.010	5,190	0.1038	1,260	0.0252	410	0.00820	845	0.01690
100,000	19,960	0.1996	1,000	0.010	10,350	0.1035	2,520	0.0252	650	0.00650	1,340	0.01340
150,000	30,660	0.2042	1,500	0.010	15,450	0.1030	3,780	0.0252	850	0.00567	1,750	0.01167
200,000	42,100	0.2105	2.000	0.010	20,400	0.1020	5,045	0.0252	1,030	0.00515	2,120	0.01060
250,000	53,995	0.2160	2,500	0.010	25,350	0.1014	6,305	0.0252	1,190	0.00476	2,460	0.00984
300,000	66,620	0.2220	3,000	0.010	30,200	0.1006	7,560	0.0252	1,350	0.00450	2,785	0.00928
350,000	79,465	0.2270	3,500	0.010	35,000	0.1000	8,820	0.0252	1,490	0.00420	3,080	0.00880
400,000	93,035	0.2326	4,000	0.010	39,700	0.0992	10,090	0.0252	1,630	0.00407	3,370	0.00842

Total and Unit Weight (per cubic meter) of Dead Load

for a maximum velocity of 120 km/h. (33.3 m/sec.)

Volume cu. m.	Engine Set		Supports of Power Plant		Cabin Control and Passengers		Mooring Cables		Dead Load	
	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.	Total kg.	Unit kg.
50,000	5,510	0.1102	725	0.0145	650	0.013	500	0.010	25,490	0.510
100,000	8,740	0.0874	1,150	0.0115	1,300	0.013	1,000	0.010	48,010	0.480
150,000	11,440	0.0763	1,505	0.0100	1,950	0.013	1,500	0.010	70,385	0.469
200,000	13,880	0.0694	1,325	0.0091	2,600	0.013	2,000	0.010	93,000	0.465
250,000	16,100	0.0644	2,120	0.0084	3,250	0.013	2,500	0.010	115,770	0.463
300,000	18,200	0.0606	2,390	0.0079	3,900	0.013	3,000	0.010	139,005	0.463
350,000	20,120	0.0575	2,650	0.0076	4,550	0.013	3,500	0.010	162,175	0.464
400,000	22,000	0.0550	2,890	0.0072	5,200	0.013	4,000	0.010	185,915	0.465

From Figs. 1 and 2 it follows that the unit weight of the envelope increases with the increase of cubature owing to the fabric of the external reinforcing part, and that, increasing the cubature up to about 200,000 m., there is an appreciable gain in the unit weight of the dead load, although this cubature gives a slightly diminished unit weight and reaches a minimum between 250,000 and 300,000 cubic meters.

Number of Passengers for a Given Flight

As we have said, by dead load we mean the whole of the essential parts of the structure; then, according to the duration and object of the journey, must be taken on board navigating instruments, the crew, the passengers, cabins, foodstuffs, baggage, tanks for ballast and fuel, etc.; in short, all that constitutes the load to be carried and which, varying from time to time, forms, together with the dead load, the fixed load.

As a first approximation, we may take the weight (in kg.) of the load which can be carried as follows:

Gangway ..... = $12\ V^{1/3}$
Wireless Set ..... = 200 kg.
Generating Set and Electric Lighting..... = $6.5\ V^{1/3}$
Engine Spare Parts and Tools..... = 0.1 (No. of HP)
Tanks for fuel and liquid ballast = 7% of the liquid contained therein if not under pressure; 10% if under pressure
Cabins and furniture for crew and passengers ..... = 25 kg. per person
Minimum Crew:
1 First Commander.
1 Second Commander.
1 Chief Pilot.
2 Pilots (Steersmen).
2 Pilots (for elevator).
1 Head Driver.

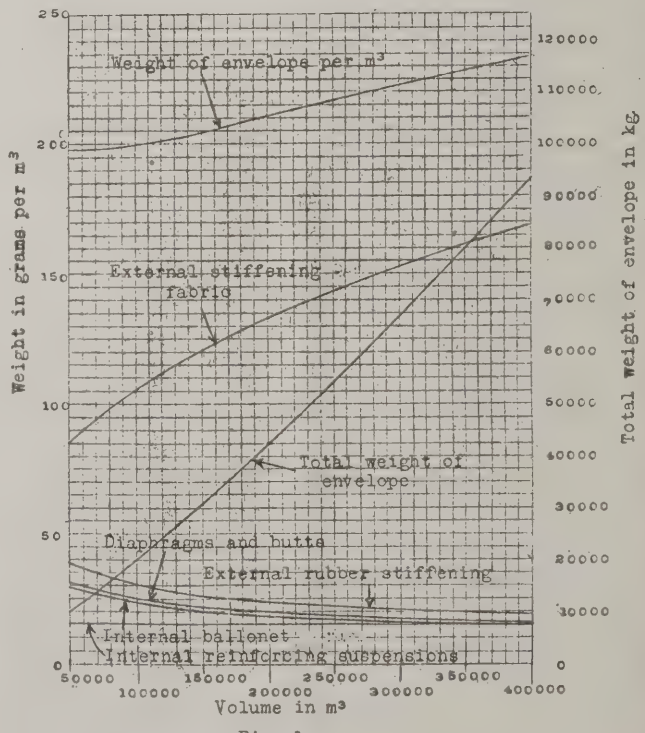


Fig. 1

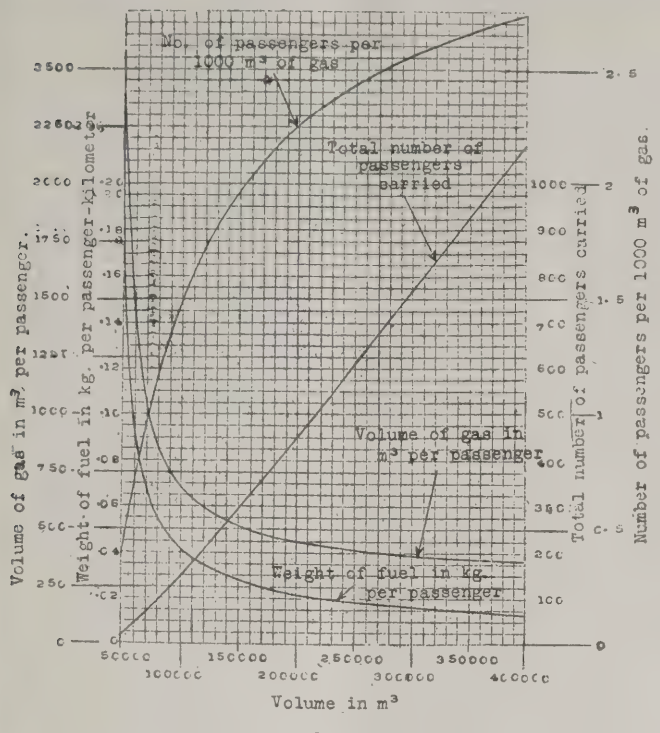


Fig. 3.

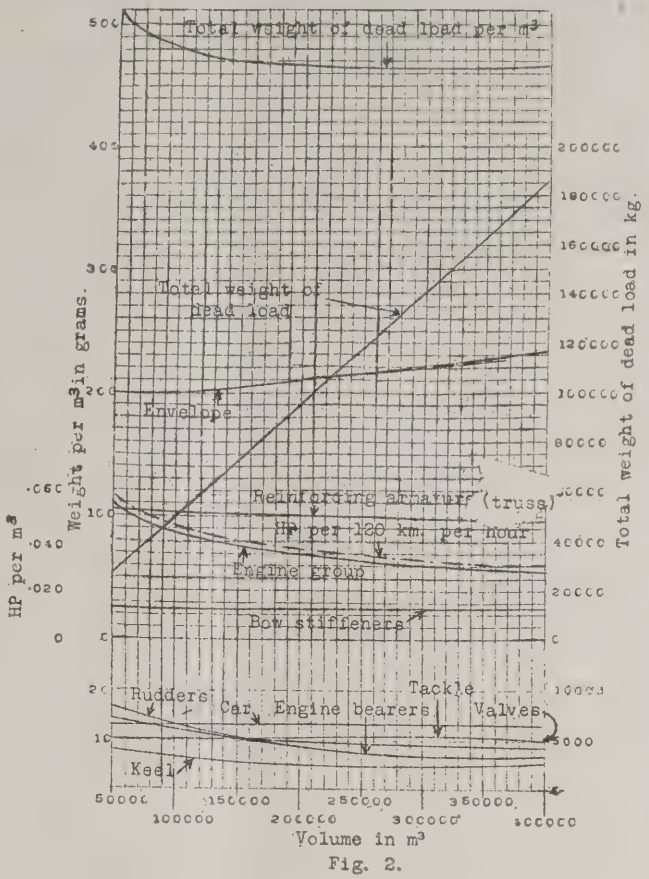


Fig. 2.

$$\frac{\text{Power HP}}{500} = \text{Number of drivers (1 for each 500 HP).}$$

2 Wireless Operators.
4 Mechanics and Riggers.

$$14 + \frac{\text{HP}}{500} \text{ average weight of each} \ldots\ldots\ldots\ldots\ldots 75 \text{ kg.}$$

Passengers, average weight of each..... 75 kg.
Baggage per person (crew and passengers) each... 25 kg.
Food and water per person for 23 hours..... 3 kg.

We will now suppose that a distance of 5.000 km. is to be covered in calm weather, at a cruising speed of 95 km/h. at half power (53 hours' sailing) and we wish to know how many passengers can be carried for the different cubatures. We will take.

1.100 kg. the lifting force of the gas per cubic meter.
0.250 kg. hourly consumption of fuel per HP.
0.050 kg. liquid ballast available per 1 cubic meter of gas.

The total weight per passenger carried will be:

Passenger ..... 75 kg.
Cabin ..... 25 kg.
Baggage ..... 25 kg.
Food for two days..... 6 kg.
Total .....131 kg.

The following Table gives the weight of the various parts of the useful load and fuel, and the number of passengers which can be carried.

Weight of Fuel of the Various Parts of Possible Load and Number of Passengers

Volume cu. m.	Lifting Force 1 cu. m. = 1.1 kg.	Dead Load kg.	Ballast kg.	Fuel for 53-hr. Flight at half power kg.	Gangway kg.	Wireless Set kg.	Generating Set kg.	Engine Spare Parts kg.	Tanks for Ballast and Fuel kg.	Crew	
										Number	Weight kg.
50,000.....	55,000	25,490	2,500	19,200	440	200	240	290	1,520	20	1,500
100,000.....	110,000	48,010	5,000	30,500	560	200	300	460	2,480	23	1,730
150,000.....	165,000	70,380	7,500	39,900	640	200	350	600	3,320	26	1,950
200,000.....	220,000	93,000	10,000	48,350	700	200	380	730	4,080	29	2,180
250,000.....	275,000	115,770	12,500	56,120	760	200	410	850	4,800	31	2,320
300,000.....	330,000	139,000	15,000	63,400	800	200	440	960	5,490	33	2,480
350,000.....	385,000	162,170	17,500	70,250	850	200	460	1060	6,140	35	2,630
400,000.....	440,000	185,910	20,000	76,650	890	200	480	1160	6,770	37	2,770

Weight of Fuel of the Various Parts of Possible Load and Number of Passengers

Volume cu. m.	Cabin kg.	Baggage kg.	Food for Crew for 2 Days kg.	Total Weight kg.	Remaining Lifting Force	Number of Passengers	Weight of			Foodstuffs kg.
							Passengers kg.	Cabin kg.	Baggage kg.	
50,000.....	500	500	120	52,500	2,500	19	1,420	480	480	120
100,000.....	580	580	140	90,540	19,460	148	11,100	3,730	3,730	900
150,000.....	650	650	160	126,300	38,700	295	22,150	7,390	7,390	1,770
200,000.....	730	730	180	161,260	58,740	448	33,630	11,210	11,210	2,690
250,000.....	780	780	190	195,480	79,520	607	45,540	15,170	15,170	3,640
300,000.....	830	830	200	229,630	100,370	766	57,470	19,150	19,150	4,600
350,000.....	880	880	210	263,230	121,770	930	69,730	23,230	23,230	5,580
400,000.....	930	930	220	296,910	143,090	1,092	81,930	27,300	27,300	6,560

The following table is made up from the preceding.

Volume cu. m.	Volume of Gas per passenger cu. m.	Weight of Fuel per passenger /km. kg.	Number of Passengers per 1000 cu. m.
50,000	2,630	0.2020	0.38
100,000	676	0.0412	1.48
150,000	508	0.0270	1.97
200,000	446	0.0216	2.24
250,000	412	0.0186	2.43
300,000	392	0.0166	2.55
350,000	376	0.0152	2.66
400,000	366	0.0140	2.73

From Fig. 3, we see that for a given length of flight, there is much advantage in increasing the cubature, both on account of the greater number of passengers per unit volume, which means a smaller cubature per passenger, and also on account of the smaller weight of fuel per passenger, which means a lower rate of transport. In the case considered of a trip of 5,000 km., there is an appreciable advantage in increasing the cubature up to 200,000 cubic meters, as was already stated for the unit weight of the dead load, but beyond that cubature the advantage is smaller.

Translated by Paris Office, N. A. C. A.

STANDARDIZATION AND AERODYNAMICS

By Col. Ing. G. Costanzi, Rome, Italy

WITH further reference to the point raised by Wm. Knight in the article on "Standardization and Aerodynamics" published in the Aerial Age of June 20, 1921, and the discussion of that article by Professor Prandtl, of the University of Göttingen (see Aerial Age of October 3, 1921) and by Professor von Karman, of the Technical Institute of Aachen (see Aerial Age of January 2, 1922), the following suggestions are offered by Col. Ing. Giulio Costanzi of the Italian Army, in connection with the matter to be taken up at the international congress of representatives of aeronautical scientific organization as suggested by Wm. Knight.

Colonel Costanzi is well known among aeronautical scientists on account of the important research work done by him at the Royal Aircraft Establishment in Rome, Italy. During the war and after the war he was the representative of the Italian Air Service to the Supreme War Council in Versailles and also technical representative of Italy to the permanent Inter-allied Aeronautical Commission in Paris.

Colonel Costanzi's Comment

It was with the greatest interest that I read the article on "Standardization and Aerodynamics" published by Wm. Knight in the Aerial Age a few months ago. The subject was not entirely new to me having discussed that matter several times with Mr. Knight who has been striving for the last two years while acting as technical assistant in Europe to the National Advisory Committee for Aeronautics to bring about a much needed international cooperation between aeronautical scientists and technical men, both in Europe and in the United States, for solving our common aeronautical problems in a true spirit of mutual helpfulness.

It is out of question that the standardization of symbols and of graphical methods of representation of experimental results as used in technical and scientific aeronautical works would be of a tremendous help to every user of such works. To curtail the individualistic tendencies of many scientists (especially in Europe) by agreeing to talk all of us the same scientific language will be of the greatest advantage to the progress of aeronautics, and this seems to be the right moment to do it, now that aeronautics is yet a new science without the burden of traditions weighing on older sciences. However, no matter how desirable it might be to agree on the adoption of international symbols meaning the same thing in every country and on the adoption of standard methods of graphical representation of results of research work, I anticipate the greatest difficulty in persuading authors of aeronautical publications to stop the prevailing practice of adopting definitions and graphical methods of their own (which a good many times are misleading the reader in another country who is not familiar with them) in the absence of any international agreement.

The other point raised by Wm. Knight in the Aerial Age about the necessity of conducting comparative tests on wind tunnels I believe is one of the most vital importance, and undoubtedly something should be done without delay in that direction in order to dispel the doubts and the scepticism which must necessarily prevail at the present time about the results of aeronautical research and investigation work being conducted in the various research laboratories.

Both Professor Prandtl and Professor von Karman in discussing Knight's article have particularly emphasized the necessity of conducting such comparative tests which might lead to a more definite knowledge of the reliability of the results obtained in the various wind tunnels and to a more intelligent and less conflicting interpretation of their comparative value, and I wish to express my entire sympathy with any plan which might bring about the desired results in that direction and to offer at the same time a few suggestions.

During years of experimental work both in the Aerodynamical and Hydrodynamical Laboratories of the Royal Aircraft Establishment in Rome, I was I believe the first one to point out in May, 1911, the existence of a change in the regime of resistance of cylindrical and streamlined struts, wires, spheres and streamlined bodies, and I pointed out at that time the difficulty offered by such changes of regime in the correct interpretation of the experimental results obtained while experimenting on a model of airplane in which wings, struts, wires, radiators, etc., all follow different laws of similitude and all have a different regime of variation of resistance depending on the dimensions of the model and the velocity of the fluid.

In 1911 I pointed out the influence of the degree of turbulency of the fluid (I was conducting my experiments in water), on the determination of the regime of fluid resistance offered by a body moving in the water at a constant velocity when the degree of turbulency of the water in front of the model was changed.

Also, while experimenting in the wind tunnel, due to the absence of an absolute method for measuring the wind velocity, my work was handicapped by lack of an exact knowledge of the absolute velocity of my wind stream. Other experimenters were working at that time under the same handicap, and the values assigned by them to the velocity of the air in the wind tunnel was in their cases as well as in my own case a question of more or less accurate measurement of such velocity.

Another stumbling block in wind tunnel work was (and still is) brought about by the interference of the supports holding the model in the tunnel—interference which is sometimes prevailing to such an extent as to completely change the phenomenon taking place in the wind stream. I tried once to reduce to a minimum the influence of the supports holding down a model of a Zeppelin 9 cm. diameter x 90 cm. long in the wind tunnel. I used two wires of .05 of a millimeter in diameter, and after measuring the air velocity in a plane perpendicular to the axis of the model at the distance of 50 centimeters from the model I could notice that in spite of the very small diameter of those wires their influence was quite distinctly felt.

I believe that in the classical experiments made by Eiffel at the Eiffel Tower which lead to the conclusion that the specific resistance of disks perpendicular to the direction of the wind increases with the increase in demensions of the model experimented upon, the influence of the supports was such as to entirely upset the experimental results obtained.

In conclusion, I like to suggest that one of the appointed tasks of the international congress of representatives of aeronautical scientific organizations as suggested by Wm. Knight should be to lay out a program of investigation work in the most important aeronautical laboratories with a view of determining:

1. Why such a lack of agreement exists between the results arrived at in the various laboratories? Is such a lack of agreement due to the lack of a perfect similarity of the models used? Is it due to the scales of the models? Is it due to the fact that the velocity of the fluid used is not exactly the same in two laboratories? Is it due to the nature of the air stream in the wind tunnel which is greatly and differently affected in the various wind tunnels after passing through differently shaped honeycombs? Or is it due to faulty measurements of the wind tunnel balances used?
2. How are the results affected by conducting the experiment either on a moving model in presumably still air or on a stationary model in a wind stream produced by either a sucking or blowing fan?

I would suggest that a series of experiments be made for determining the resistance of spheres of various dimensions falling a certain height when compared to experiments made on the same spheres under analogous conditions in a wind tunnel.

It would also be interesting to make experiments in a specially designed closed circuit wind tunnel where thin or com-

(*Concluded on page* 575)

NAVAL and MILITARY AERONAUTICS

Accomplishments at McCook Field, Dayton, O., During the Past Year

In a recent issue of "Slipstream," published at McCook Field, Dayton, Ohio, Major T. H. Bane, Chief of the Engineering Division located at that station, reviews the accomplishments of the past year, and states that a careful analysis of same will force any reasonable man to the conclusion that the work of the Division has been worth while.

Among the achievements of the year, aside from Lieutenant Macready's altitude record, are the following:

The 700 h.p. "W" engine, which was built last year, has successfully passed its 50-hour test. A small number which were ordered have been received and are now being tested. This engine has been incorporated in the design of several aeroplanes, one of which is now at this field.

Following the same procedure as was followed in the development of the 700 h.p. "W" engine, a 1,000 h.p. engine is now being built. This procedure consists of completely developing a single cylinder on the flexible engine last year and letting the contract this year for the complete engine.

A remarkably compact engine of the barrel type, with many advantages over existing conventional types, is actually under construction.

With the cooperation of the Material Section, the Power Plant Section has been able to develop a very promising air-cooled cylinder.

Mr. Verville and the Power Plant Section have gotten out during the past year a very creditable pursuit aeroplane about the Packard 300 engine.

Mr. Laddon, who seemed destined to break the ice in new forms of construction in this Division, has gotten out the CO-1, which passed its sand test except for minor defects, which it is believed will be corrected. This duralumin aeroplane is the first attempt in this country to build a complete duralumin aeroplane, and gives every promise of success. The flying model should be in the air soon after the first of the year.

Mr. Roche completed the construction of the training aeroplane about the Liberty 6 (TW). This aeroplane contains some very interesting features, particularly that portion designed to lessen the number of fatal accidents in training. Mr. Roche also designed last year the CO-2, or Corps Observation aeroplane, of steel tubing, about the Liberty engine. This will be built during the present fiscal year.

The work of this Division in successfully supervising the development of the Packard series of engines is very praiseworthy, as is also the work of the Aeroplane Section in supervising the experimental construction of the following aeroplanes:

The Loening Monoplane, which resulted from over three years' careful study by Mr. Grover C. Loening, seems to be a real promising pursuit type. Several modifications have been incorporated in two additional aeroplanes and a small production order will be made this year. This aeroplane has some very interesting and unusual features.

The sand test model of the armored pursuit about the 300 h.p. cannon Wright engine has been received and looks like a serious undertaking. It will be remembered that this aeroplane was designed at this field by Mr. Laddon's group and built by the Aeromarine Company.

The sand test model of the Loening biplane about the 350 h.p. Wright radial air-cooled engine has been received and shows a great deal of intelligent engineering. It is a very interesting pursuit type, and is a great credit to both the Loening Engineering Corporation and to the engineers in this Division who assisted in the criticism and changes in the design.

The sand test model of the Gallaudet day-bombardment aeroplane about the 700 h.p. "W" engine has arrived at this field and has created a most favorable impression. It is a source of great satisfaction to this Division to see that Mr. Gallaudet and his organization have done what appears at first glance to be an excellent piece of work in the development of this all-metal aeroplane. It certainly impresses one as a distinct advance in the science. This model has not been sand tested and may require considerable modification.

During the past year we have added to our organization the Balloon and Airship contingent, including two main sections, the Balloon and Airship Section and the Transportation Section.

The equipment Section have continued the development of the multitudinous variety of articles for which they are responsible in a most satisfactory manner. In this connection, the work of Captain Stevens and Lieut. Wade in the White Mountains is mentioned as a most creditable performance on the part of these officers and is another feather in the cap of the Engineering Division. Certainly, this type of thing was never done before and was performed in this case with practically a perfect score.

The earth inductor compass, cloud flying instrument board, non-frosting goggles and radio controlled car are some of the "high lights" in the work of the Equipment Section.

The Armament Section, although practically swamped with projects and deprived of its former chief, Major Hobley, has accomplished many very difficult tasks under the able leadership of Captain Kauch. The perfection of the electrical synchronizer and the 4000 pound bomb rack, the Estoppey Bomb Sight, the Universal bomb hoist and the improvement of the nose of the Martin Bomber to facilitate accurate bombing, are some of the main accomplishments.

The Material Section has handled a great amount of current testing and has convinced the other Sections at the field of its desire to help with their problems, and a very excellent cooperation has been built up.

Xbia Ships for Night Flying

The 30th Aero Squadron, stationed at Kelly Field, San Antonio, Texas, reports night flying a success and the XBIA's as excellent ships for this work. Several officers of the 2nd Bombardment Group participated in the flying, in addition to the personnel of the 3rd Group (Attack).

Spads to Be Flown at Ellington Field

A number of Spad 13's held in storage at the San Antonio Air Intermediate Depot are being equipped with Wright 180 h.p. engines for use of the First Pursuit Group at Ellington Field. These Spads are to be used by pursuit students as a step up to the MB3, which will be available shortly.

Japanese Officers Visit Mitchel Field

Colonel M. Fuki, Colonel Y. Arakiki, Major T. Watanabe and Major N. Tanifuji, of the Imperial Japanese Army, were guests of the Commanding Officer of Mitchel Field, Major W. R. Weaver, on January 9th, and made an inspection of the post.

Bombing Pilots Graduate at Kelly Field

Thirty-three officers and six cadets successfully completed the course of training for bombardment pilots conducted by the 2nd Bombardment Group at Kelly Field, San Antonio, Texas, and graduated on December 22, 1921. Captain Arozarena of the Cuban Air Force and Lieutenant Brown of the Argentine Navy were numbered among those who successfully completed the prescribed tests. Captain Arozarena immediately departed for his native soil, promising to remember all his friends at Kelly Field while celebrating Christmas in "old time style." Lieut. Brown is leaving for London, Eng., where, in company with other officers of the Argentine Naval Forces, he will inspect and test Avro seaplanes which his government is purchasing. Upon completion of this duty, these officers will return to New York and perform like service in connection with the purchase of F5L seaplanes in this country. Lieut. Brown has been in the Government Aviation Schools in the United States for two years, having first received training on seaplanes at the Naval Aviation School, Pensacola, Fla., then primary training on land planes at Carlstrom Field, with advanced training on same at Kelly Field.

Mather Field Notes

The second class of flying cadets started in cross country formation work last week.

Three new DeHaviland 4-B-1 planes were flown from Rockwell Field by Lieutenants R. L. Maughan, P. L. Williams and Ned Schramm of this command; Lieutenants Maughan and Schramm having ferried two planes from Crissy Field to the Repair Depot, Lieutenant Williams going by train and delaying en route at Los Angeles to attend the funeral of his grandfather.

Numerous visitors, via air, were guests at the field for short periods during the week: Lieutenants J. W. Benton, B. C. Catlin, Jr., J. R. Glascock, E. C. Kiel came up from Crissy Field. Civilian fliers stopping at Mather were Aerial Mail Pilot Eaton, enroute to Reno, Mr. Clevenger in a Pacific Standard from San Carlos and Messrs. Murphy and Russell from Marina Field.

FOREIGN NEWS

Aviation in Chile

Some activity is noticed in the Republic for the forming of a Naval Flying Service at Las Torpederas, near Valparaiso.

Eight modern types of flying-boats are already being used. Las Torpederas is an old naval school not now much used. Large modern hangars will be erected as well as workshops.

Progress in Ecuador

El Telegrafo of Guayaquil, one of the oldest newspapers in the Republic, has purchased a Nieuport biplane with a 130-h.p. Clerget, and has secured the services of the Italian airman, Lieut. Ellia, to undertake the flying for *El Telegrafo*.

The owners of the *El Telegrafo* have shown great enterprise in being the first in the field with a private machine, the which is carrying out some record flying for Ecuador.

Some of the recent flights made are Guayaquil to Cuenca, 160 km., Cuenca to Riobamba, 180 km., Riobambo to Quito, 184 km., Quito to Ibarra, 94 km., Ibarra to Tulcan, 83 km., Tulcan to Pasto, 100 km. In each of the flights made *El Telegrafo* was delivered in record time relatively to the slow rail transport in Ecuador.

Signor Ferruccio-Guacciardi, another Italian airman in the Republic, is out to break all previous records for height and distance on a Salmson biplane shortly.

Morocco Air Post Charges Reduced

The British Postmaster-General announces that the special air mail fee which is payable in addition to the ordinary foreign postage rate on packets posted in this country for Morocco and directed to be forwarded by the French Air Mail Service from Toulouse to Casablanca is now reduced. The new rates will be as follows:—

3d. up to ½ oz.; *6d.* up to 3½ oz.; *3d.* for each additional 3½ oz.

Postal packets by the Toulouse-Casablanca Air Mail service will also in future be subject only to the same conditions regarding maximum weight and dimensions as those forwarded all the way by the ordinary route .

Packets may be posted up to 6.30 a.m. (printed papers 6 a.m.) at the General Post Office, London, on Monday, Tuesday, Thursday and Saturday, to connect with the air mails for Morocco which leave Toulouse on Tuesday, Wednesday, Friday and Sunday respectively. The mails are due to reach Casablanca on the following day in each instance. The public, both in London and the provicines, are advised to send their postal packets by the air route on any day of the week, as in the normal course transmission will be greatly accelerated.

Flying the Desert

A very human story of flying the Desert *en route* from Cairo to Baghdad appeared recently in the London *Times* from a Special Correspondent. The methods employed from start to finish are detailed and the flight over the Desert itself is well described as follows:—

"The flight from Amman onwards is across the Arabian Desert to Ramadi, a distance of about 600 miles. Except here and there, there are few physical features which would be of much assistance to a pilot in finding his way; and although it would be possible to fly on a compass course until the River Euphrates was reached, it would be very difficult to find where a machine would land on account of engine trouble. In order to overcome these difficulties, a track has been made by a number of motor lorries following each other across the desert.

"The desert is not pure sand, but sufficiently loamy to adhere when squeezed in the hand, and camel scrub and other vegetation spring up after the rains which come between November and April. The general level varies from about 1,500 to 3,000 ft. above sea level, with considerable local undulations, watercourses, mud flats and rock outcrops, so that the car track is by no means a straight one, but winds about, choosing the easiest path. Large arrows have been made in the soil to indicate to the airman a coming change of direction. Twenty suitable areas for a landing have been marked with large circles in the course of the 600 miles. Some of these landing-grounds are of a gravelly nature and some are mud flats. The track does not get covered up, as it probably would in sand, and although it is difficult to pick up in places, it is, generally speaking, fairly easy to follow, and, so far, does not seem to be affected much by the limited amount of rain which falls in these parts.

"Due to certain misadventures, the party was three days on the journey, although the time in the air was only 10 hours, and in the summer there is no difficulty in going from Cairo to Baghdad in the day. To reach Baghdad, except by air, would entail going to Port Said, catching a steamer to Basra on the Persian Gulf, by way of Bombay and Karachi, and from there by train—a journey of about 30 hours—to Baghdad. This route would probably take a month, and this short description of the new air mail route to Baghdad is an illustration of the great saving of time in the new method of travel. An additional advantage is the feeling of freshness on landing as compared with the effects of a railway journey of similar length, an important matter to business men."

Sir Ross Smith's New Adventure

It is now some time ago that the first rumours were heard of a proposed flight around the world by Sir Ross and Sir Keith Smith. It appears that plans are now fairly advanced and that there is a possibility of the flight starting within the next three or four months. We understand that Sir Ross intends to use a Vickers "Viking" amphibian, and after hearing his lecture on the flight to Australia and seeing the films, one feels convinced that the amphibian type of machine is the right one for the purpose. It is true that the land gear weighs a good deal, but on the other hand such a machine is not so restricted to long stages between aerodromes as is the ordinary land machine. The route to be followed has not been definitely decided upon, but it will probably be the eastern one—*i.e.*, London to Cairo and Baghdad, *via* France, Italy, etc., and thence to India, China, Japan, Alaska, Canada, Newfoundland, Azores, and home. The most difficult part of the route will, of course, be the Atlantic crossing, but if the route be laid over the Azores the distances should be within the capacity of the "Viking."

Diesel Engines for Aircraft

According to the Aviation Correspondent of the London *Daily Telegraph*, there is reason to believe that the Diesel type of engine will soon be a practical proposition for use on aircraft. We wish we could share his optimism. Although the type will probably be modified to suit aircraft conditions some day, we have no great hopes of this happening in the immediate future. At the Paris Aero Show was exhibited a radial engine which was said to be designed for operation on the Diesel principle. In view of the high compressions reached, however, it appeared distinctly on the light side, and although it represents an attempt at solving the problem, we should not think that success is yet within sight.

Aviation Development in Italy

A policy of strict economy in army expenditures is to be inaugurated by the new Italian Minister of War, the Hon. Gasparotto, who has been in office about five months. Both Military and Civil Aeronautics in Italy are under the Minister of War, and he recently made the following statement of his intentions concerning the Air Service:

"It is my intention to cut down all branches of the Army including the Air Service. The Military Air Service will be kept within the limits strictly essential for proper war preparation. The devolpment of civil aviation must be undertaken on a large scale. In this manner the appropriations for aeronautics will not be wasted in industrial ventures of which the State is always a most unfortunate administrator. The appropriations are to be spent wisely; for specific experiments, for the purchase of new material, for the preparation of the personnel, and for equipping the various branches of the Air Service. As far as possible recourse will be had to private enterprises, stimulated by free competition, rather than to Government establishments which are a burden to the State and are apparently kept up to maintain the employees in service. The plan for reforming and reorganizing the Air Service has been drawn up by the Advisory Committee for Aeronautics, but the Army Air Service must be duly considered and any reorganization must go hand in hand with the Army organization.

Civil Aviation will receive the greatest possible support from the Government, but always with the idea of developing and in full cooperation with the Military Air Service. Thus, with a minor expenditure of money there will be created not only a strong Air Service for Italy's possible future defense, but also a source of industrial wealth and a large exportation.

International Aviation Races in Italy

The Italian Minister of War has just approved a plan submitted by the Chief of Air Service (Comando Superiore di Aeronautica) for several big International Aviation Races and competitions to take place in September, 1922. The object of these competitions is to increase the creation and construction of new types of aeroplanes, and prizes will be taken from Air Service funds appropriated for that purpose.

The first race will be known as the "Grand Prize of Italy" and will be for aeroplanes. The prizes for this competition will consist of a Cup valued at 30,000 lire, a first prize of 150,000 lire, and a second prize of 50,000 lire.

The second race will be known as the "Grand Prize of the Tyrrhenian Sea" and will be for seaplanes. In this competition, the prizes will be of the same amounts as those for the "Grand Prize of Italy."

In addition to the prizes, 400,000 lire will be spent for the purchase of the Italian aeroplanes which make the best showing in these two competitions. As at present outlined, each race will be 2000 kilometers over a circuit not less than 500 kilometers in length. In addition to these two races, it has been decided to have parachute competitions, the descents to be made from aeroplanes. Prizes to the amount of 500,000 lire will be awarded in the parachute competitions, which will also be international.

There will be held also a competition for free balloons, the money prizes in this competition amounting to 30,000 lire.

As soon as the detailed regulations governing the above competitions are drawn up information thereon will be forwarded.

Prior to his appointment, the new Minister of War was a member of a group of fifty representatives in the Italian House of Representatives known as the "Aeronautical Group." This group is made up of representatives from various political parties, organized and pledged to support and assist in all legislative matters for the organization and development of Commercial Aeronautics. Up to the present time this group has not succeeded in getting any of its proposed legislation through the House. A similar organization has just been organized in the Senate along the same lines and for the same purposes. In consists of from 40 to 45 members at present, including many of the most prominent Senators, in addition to those who are most prominent in industry and science.

Marking Landing Fields in Argentina

The Ministry of War has ordered that on each landing field belonging to the Government and under said Ministry, a visual signal is to be painted consisting of one, two or three capitals placed in the center of the field. The upper part of these capital letters will face the north. The letters will be painted as if each one were surrounded by the lines of a rectangle of 20 by 10 meters. Each letter will have a width of 3 millimeters.

The military aerodromes will have a horizontal band three meters in width on the lower part of the letters right across same. The letters may be made either out of brick, wood, or any other material, and should be inlaid in the ground so that they will not mean the slightest obstacle for the taxying of the aeroplanes; also they will be whitened with lime, in order to be able to distinguish them from high up.

Civilian aeroplanes will not be allowed to land on fields where military aerodromes are located without previous authorization or, in case of serious trouble, when permission will be requested from the air by given signs.

International Competition for Aviation Engines in Italy

The Chief of the Italian Air Service is organizing a large international competition for commercial aviation engines, to take place in the Fall of 1922 or the Spring of 1923. Plans are being drawn up along lines already approved by the Minister of War. Money prizes from Air Service funds amounting to one million lire will be offered.

The large money prizes offered in this competition, as well as in those for aeroplanes, seaplanes, parachutes and balloons which are to participate in the big International Aviation Races and Competitions to take place in September, 1922, viz.: the "Grand Prize of Italy" and the "Grand Prize of the Tyrrhenian Sea" are to be awarded to manufacturing houses. The Italian Air Service is very anxious for American manufacturers to compete in these events. Detailed regulations will be sent when completed and approved.



Impulse Soaring

By A. P. Herff

IT seems to be the general belief among authorities that soaring flight, as practised by certain species of birds, finds its explanation in rising air currents, and though soaring could be accomplished by these, I have always had my doubts that they are so generally distributed and possess the necessary rate of ascent, as to explain this phenomenon.

I have on many occasions watched our native turkey buzzard circling on motionless wings and gain altitude with a rapidity that seems to exclude the rising current theory, considering that such a current must have a vertical ascending component in excess of the bird's vertical descending component while gliding.

When the bird returns to its roost and its flight is in a straight line, it does so by alternately flapping and gliding. This leads me to believe that its wheeling flight is not only in search of food, as has been suggested by some, but is actually necessary to accomplish soaring; and I have therefore come to the following conclusions:

The Behavior of a Machine Gliding Through Gusts

Let Figure 1 represent a side view, in which *a b c d* is a section of an air gust, travelling in the direction shown by arrow *J*. For convenience let us say that the air in front and

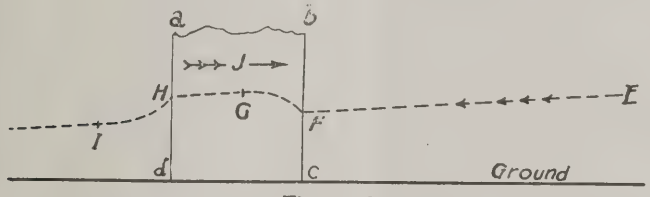


Figure 1

A side view, showing the path followed by a bird gliding in an air gust

back of this gust is calm. Now let us suppose that a glider at *E* is gliding in the direction *F*, a point on the crest of the gust, and descending at its normal gliding angle. When the glider reaches the point *F* on the gust, its velocity relative to the air will be increased by an amount equal to the speed of the gust, and the machine begins to rise, until a point *G* is reached, where its momentum will be neutralized, and it begins to settle

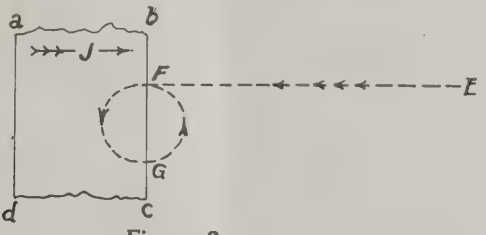


Figure 2

View from above, illustrating the manner in which a soaring bird wheels into and out of the front part of an air gust

down to its normal gliding angle, continuing to glide until a point *H* on the rear of the gust is reached. Here it emerges into calm air, in relation to which its speed will be less than its normal gliding speed had been from *E* to *F*, by an amount equal to the speed of the gust. Its speed now being too low for sustenance, will cause it to dive, and thereby gaining velocity, will resume its normal gliding angle at *I*. The foregoing would show the behavior of a machine gliding through a gust, and would explain the bumpiness so often experienced by aviators.

How Height Is Gained

Let us see how a bird utilizes the same gust to continuously gain elevation:

Figure 2 represents a view from above and Figure 3 a side view. We will assume a bird at *E* approaching the point *F* and descending at its normal gliding angle. When it reaches the point *F*, its velocity in relation to the air (like the glider) will be increased by an amount equal to the speed of the gust. From the point *F*, however, it begins to wheel in the direction of the arrow, Figure 2, and rises by the impact of the gust, as shown in Figure 3. At *G* its momentum will have been neutralized and it is gliding with the gust. Its velocity in relation to the calm air in front of the gust will be equal to its gliding speed plus the speed of the gust. Emerging, it begins to rise by the impact with the calm air, while gradually turning into the gust, and at *F* will have resumed its normal gliding speed in relation to the calm air. During these manoeuvres the bird passes into and out of the front part of the gust, but not through it, and the impact on entering will

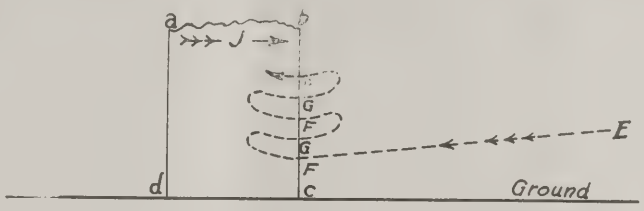


Figure 3

Side view of the manoeuvre shown in Figure 2, illustrating how altitude is gained while the bird is circling

be equal to the impact on emerging. It is obvious that it will have gained elevation, and the operation need only be repeated in order to obtain altitude with every revolution.

To an observer on the ground the general direction of the flight of the bird will be that of the wind, and its speed that of the air gust. When sufficient elevation has been attained, the bird glides in the direction it chooses, and repeats the operation, when altitude has been lost.

It follows, therefore, that were the ascent of a bird slow (as would probably be the case if local rising air currents were utilized), too much ground would be lost before sufficient altitude had been gained, and soaring could only be practised when drifting with the wind. Observation, however, does not seem to support this.

A Suggested Method of Practice

A good way to practise soaring would be to use a low powered machine with a good gliding angle, and having the ability to make short turns. The gliding angle could be improved by using the motor throttled. It would be an advantage to use a propeller which automatically increases its pitch when the motor is throttled, thereby avoiding excessive motor speed and saving fuel. A gusty day should be chosen, and a fire creating a dense smoke built upon the field. The machine should start and rise under power, until a safe altitude has been obtained, when it should be pointed in the opposite direction of the smoke, and throttled down, so that it will be descending at a slight angle. When a gust is encountered, the machine will show a tendency to rise, which the pilot should encourage, and at the same time begin to wheel until he is flying in the direction of the smoke. He should continue to fly in this direction until he has overtaken the crest of the gust, and on emerging into calm air, should again experience a tendency to rise. Again encourageing this, he should gradually wheel back into the gust, repeating this operation until the desired height has been gained, when the aviator (like the bird) may glide in the direction he chooses.

It appears that considerable lift could be obtained from the wind by following the above manoeuvres, as the impact with a gust would cause a lift proportionate to the (gliding speed + the speed of the gust)^2, whereas the lift of the glider during its normal glide would be the (gliding speed)^2.

The exceedingly rapid ascension of the buzzard seems to support these conclusions.

In order to detect the frequency and width of these air waves, one need only fly a kite and watch its rise and fall.



Mary's Camel

Mary had a Camel;
  And she went up to fly.
She thought that she could handle it
  As well as you or I.

She took off; and went up and up
  Into the sky so blue.
At length she thought that she would throw
  An Immelmann or two.

She gave it stick and rudder.
  The nose went up,—and gee!
She was as a shipwrecked mariner
  Upon a stormy sea.

Well, Mary got down safely
  And asked what she'd been in.
The spectators informed her, she'd
  Done two rolls and a spin.

—*Ad Astra.*

"A caller with a poem wants to see you, sir."
"The devil! What's his name?"
"It's a young lady, sir, an' she's a peach."
"Ah! show her in. I'll be glad—a-hem!—to look at her lines."

Jane, five, had gone with her parents to visit at a college at Cornell, and had gathered some amazing information. Shortly afterward, at Sunday School, the teacher asked:

"Can anyone tell us about Noah?" Jane's hand went up and she rose, bursting with knowledge.

"Way back there in the ages dark, old man Noah built a sea-going ark," she quoted from a song the college boys had sung. "And when they passed Coney Island shore, the lion let out out an awful road. 'What's the matter,' says Noah; says the lion: 'I'm sore; you're going to sell us to Ringling—'"

"Why, Jane," gasped the teacher. "An' every day at half past three, Noah played poker with the Chimpanzee—"

She was drawn firmly but gently down into her seat at this place and the teacher hastened to ask more questions of the admiring and envious class.

"Please," piped up Jane, waving her small hand again, "Noah had a full house up his sleeve—"

The desparate teacher looked about helplessly and then announced that Jane may pass the Sunday school papers.

Doctor—"My dear chap, I'm glad you called me when you did."

Patient—"Why doc—are you broke?"

Edith—Alexander got a quarter for mowing the lawn and it only took him an hour. I get a quarter for washing dishes for a week.

Mother—I know dear, our kind of work is greatly underpaid, isn't it?

Edith—Well, I guess there's nothing for us women to do but get married.

Fortunate

MAE: Isn't it fortunate?
KAY: What?
MAE: That people can't read the kisses printed on a girls' lips.

JACK: Some terrible things have been caught from kissing.
GEORGE: I should say so! You ought to see the poor worm my sister caught.

One hand was all he used to steer,
  The other arm hugged Myrtle.
They did a skid—and then oh, dear,
  The beastly car turned turtle.

YOUNG MAN: This is the age of youth. Youth sets the pace in the race of life today.

OLD MAN: Yes and youth starts off at a sprint, cannot keep up the pace, and in the long run, old age overtakes us all.

They Say the Designer Went "Nuts"

Personnel: Two mechanics and pilot engaged in doubtful business of starting 110 *LeRhone.*

FIRST MECH.: Let's give her a shot!

2ND MECH.: No, she'll go all right, "essance coupé"!

PILOT: "Essance coupé"!

Second mechanic proceeds to wind her up and suck in gas.

1ST. MECH.: Three times over is 'nuf; too much is as bad as not at all!

Both mechanics tie into the stick and get set to "throw double."

2ND. MECH.: Contact!

PILOT: Cognac!

Mechanics count three and throw her over—everything as silent as grave.

1ST. MECH.: Kontak!

PILOT: Cognac.

Mechanics make same counts, same moves, same results. Now they prime every other one.

1ST. MECH.: Let's go again, Kontak!

PILOT: Cog—just a minute fellows, I didn't have my switch on.

TWO MECHS.: !*—:!?c—damn it!!!!

2ND. MECH.: Contact!

She takes it after the throw—makes two revs forward and kicks back three.

PILOT: Hooray!!

1ST MECH.: Horray!—hell, she's timed ahead.

2ND MECH. (He did the timing): No, she's all right, let's go—kontak!!!

PILOT: Contact!

No business.

1ST MECH: KONTAK!—Guess that was embalming-fluid you primed it with!

PILOT: Contact!

2ND MECH: Leave it on contact all the time—kontak! No wonder these things drove the designer "nuts".

This followed by long series of kontak! coupé! contak! coupé! and side remarks.

PILOT: How about cleaning the distributor ring?

2ND MECH: It's clean—contak! The designer was nuts before he thought of this!

PILOT: Contact!

1ST MECH: Kontak (he's around looking into the cockpit now). Say! have you had your hand on that coupé button all the time?

PILOT: What's this? (finding coupé button on stick) you see boys, I've been flying Camels.

2ND MECH: (Oh, what he said was awful.)

They try a whole lot more of the strong arm stuff with the usual French and the usual results, then decide to clean the distributor ring and in so doing turn a white rag black.

1ST MECH: Contact!

PILOT: Cognac!

She makes a weird wheeze and kicks both ways a few times, sending out a smoke cloud through the intake pipes.

PILOT: Ah! She's too rich, turn her back a few times.

Mechanics rack 'er back a dozen whirls till she begins to look lean. They throw it over again and again, talk to it, talk about it, and then (worn out and in a sweat) work on in silence, except for the necessary, low toned contact! coupé! kontak! coupé!

2ND MECH: Gas off, and contact. (He reaches in for the spark-plug wire and rocks it across the firing-point, is disappointed when he doesn't break his arm, feels a little juice and is satisfied. He then changes nine plugs and several wires, takes out the carbon pencil, inspects his "ground" and does a few other little things.)

BOTH MECHS: Contact!! (With new life and hope.)

PILOT: Cognac! (With very little hope.)

A few more contacts! and a few more coupés! and both mechanics drop to the turf and say strange things about "whirling-sprays" and "nickel-plated—s-pots." The pilot knows when not to talk or offer suggestions but; then it happened, one mech begins throwing gloves, hat, wrenches and stones at LeRhone and pilot remembers: Atta boy, that's what they like, now try it!

MECH: Contact!

PILOT: Cognac!

AIR LAIRD PLANES WICHITA KANSAS

The Laird Swallow
"America's First Commercial Airplane"

THE Swallow's carrying capacity—three passengers, baggage and full fuel load—is one of the reasons that it is fast becoming America's most popular commercial ship. Let us send you our booklet.



Now Priced at $4,500

E. M. LAIRD COMPANY
Manufacturers
WICHITA, KANSAS
General Sales Offices
2216 SO. MICHIGAN AVE., CHICAGO

E. M. LAIRD CO.
2216 So. Michigan Ave., Chicago, Ill.
Please send me details of your new sales plan and copy of booklet.
Name .....
Address .....
.....
AA

(*Concluded from page* 559)

(c) The types of development for which the company is peculiarly fitted; whether it has devoted its resources to the production of small ships or large ships, or land or water craft.

(d) The location of its organization, as it might relate to ease of communication both for development work and also ultimate shipment of its material.

(e) The amount of business or turn-over shown to be necessary to keep the organization in a healthy state of operation, realizing constantly that the ultimate aim of the company should be to take its proper place as a producer in civil aviation, when conditions permit.

Such a survey of the aircraft situation at the present time, it is believed, would reveal many very gratifying facts, among which might be mentioned that, contrary to the general belief in this country, aircraft development is not far behind that in Europe in some lines, while in some other lines it is distinctly ahead of Europe. The burden of this development, especially since the war, has been borne by comparatively few industrial units and at very great individual loss.

It must be remembered that this matter of superiority of practical designing ability and equipment should be the primary consideration. It should govern all conclusions resulting from this survey.

Having reached a conclusion with reference to the present situation and the needs of the future, the real problem now presents itself: How can the Government's business be allocated under the law to permit of healthy development? Under normal conditions, competitive bidding should be the solution and it is believed that competitive bidding qualified by the individual resources and adaptability of the bidders is the proper solution; so long as this bidding is restricted to a responsible list of bidders gained from the above survey and further by the proper withdrawal of bidders who have already received their sufficient quota of business.

Whether such a policy would be operative under the present legal restrictions is the question for the Departments to solve. Possibly, there are other ways to secure the same end.

That some method must be arrived at without delay is too evident to need emphasis for, without a definite policy, the existing aircraft builders will continue to waste their own money in constantly changing their facilities of organization and operation and will finally destroy the very factors upon which the sane development of aeronautics depend.

Nothing has been said in this review with reference to aircraft motor design and manufacture, but the same facts and conclusions pertain in quite as forceful a degree to this branch of the industry and they should receive the same treatment as is necessary in aircraft development.

(*Concluded from page* 570)

pressed air, hydrogen or other gases could be used as suggested by Ing. Ottorino Pomilio in Italy and by Mr. W. Margoulis in France.

3. Why the ratio $\frac{Rx}{Rx}$ increases with the velocity in the wind tunnel when experimenting upon some models of airplanes? An aluminum model of airplane which I had recently tested out at the Central Aeronautical Institute in Rome showed an increase of $\frac{Ry}{Rx}$ in the order of 22 per cent when tested at 15m/sec. and 35m/sec. respectively, the angle of incidence being the same in both cases, viz. 3°. I should be glad to place that model at the disposal of other laboratories for further tests.

Before concluding my remarks about the discussion on "Standardization and Aerodynamics" appearing in the Aerial Age, I wish to state that there is one point more on which I entirely agree with Wm. Knight, and that is the necessity of inviting the Germans to participate in any international settlement of the various questions affecting aerodynamical research work.

I should think that if we are going to have a congress of representatives of aeronautical scientific organizations, the first meeting of such congress should be held in Germany, where experiments of the highest order of both scientific and practical importance have been conducted in the last few years with the usual German thoroughness and accuracy.

TITANINE

TRADE MARK

DOPES AND COVERING MATERIALS

Can be obtained through

JOHNSON AIRPLANE & SUPPLY CO.		Dayton, O.
F. J. LOGAN	712 Superior W.	Cleveland, O.
F. C. AYARS	Box 294	Beaumont, Calif.
JAMES LEVY	2055 Indiana Ave.	Chicago, Ill.
DE LUXE AIR SERVICE		Asbury Park, N. J.

or from

TITANINE, Inc., Union, Union County, N. J.

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

PHILADELPHIA AERO-SERVICE CORPORATION

636 Real Estate Trust Bldg. **Philadelphia**

MOTOR REBUILDING

CYLINDER GRINDING

ALUMINITE PISTONS

Iron Pistons, Piston Pins and Rings.

COMPLETE MOTORS

Parts for all airplanes and motors.

Finest equipment in U. S. for motor work.

GREEN ENGINEERING COMPANY

Dayton, Ohio
Main St., at Burns

THE OLD RELIABLE

Splendid Quality Reasonable Prices

Fastest Shipments

Curtiss JN4D, Canuck, J-1 Standard and Oriole Airplanes, Flying Boats, new and used OX5 and OXX6 Motors, and all manner of parts for said airplanes and motors.
New or used K-6, C-6, Hispano and Mercedes, 150 H.P. Motors and Benz 120 H.P. Motors, and J-1 Standard airplanes equipped with any of those motors.
Grade A Mercerized cotton 55c yd.; tape 6c yd.; Grade AA linen 90c yd.; tape 9c yd. New Nitrate Dope, Guaranteed, $2.75 for 1 gal., $10 for 5 gals., including dandy can; in bbls., $1.75 per gal. Wing covers, shock absorber cord, 26 x 4 casings and tubes, propellers, wings, resistal goggles, etc.; leather helmets $6, heavier weight $7. All manner of supplies. Write for what you want.

FLOYD J. LOGAN

712 West Superior, Cleveland, Ohio
Phone Cherry 949

SPECIAL OFFER

New wheels with casing and tube

$12.00 comp. F. O. B. Buffalo

Canuck JN4 and 0X5

Spares and Supplies

Special prices from now until end of season. Act quick, don't wait until Spring to refit; use your spare time in the winter season.

Write us direct for quotations

ERICSON AIRCRAFT LIMITED

120 King Street E. **Toronto, Canada**

Protect papers from prying eyes

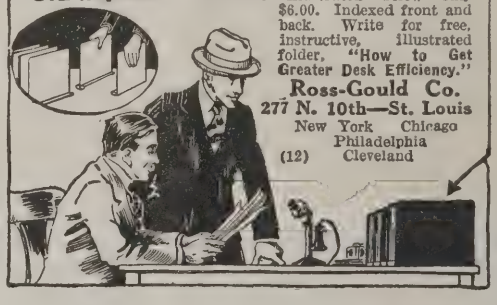
Guard against damage from prying eyes and the unconscious glance of visitors at your desk. It is convenient and efficient to always file confidential papers in a

Kleradesk

Filed vertically, important documents cannot be read; are out of way but immediately at hand when needed.

A Steel Sectional Device

Add compartments as required. Sections $1.20 each. Four-compartment Kleradesk illustrated below only $6.00. Indexed front and back. Write for free, instructive, illustrated folder, "How to Get Greater Desk Efficiency."



Ross-Gould Co.
277 N. 10th—St. Louis
New York Chicago
Philadelphia
(12) Cleveland

NOW AVAILABLE FOR YOUR AUTO

"The Plug That Cleans Itself"

Saves Gas **B-G** More Power

GUARANTEED CARBON AND OIL PROOF

Recognized as the best for aeroplanes, its success for automobiles is assured

B - G CORPORATION
33 Gold St., New York

If your dealer cannot supply you, send us his name and $1.00 for each plug, stating name and year of manufacture of your car.

PILOTS

What you have been waiting for!

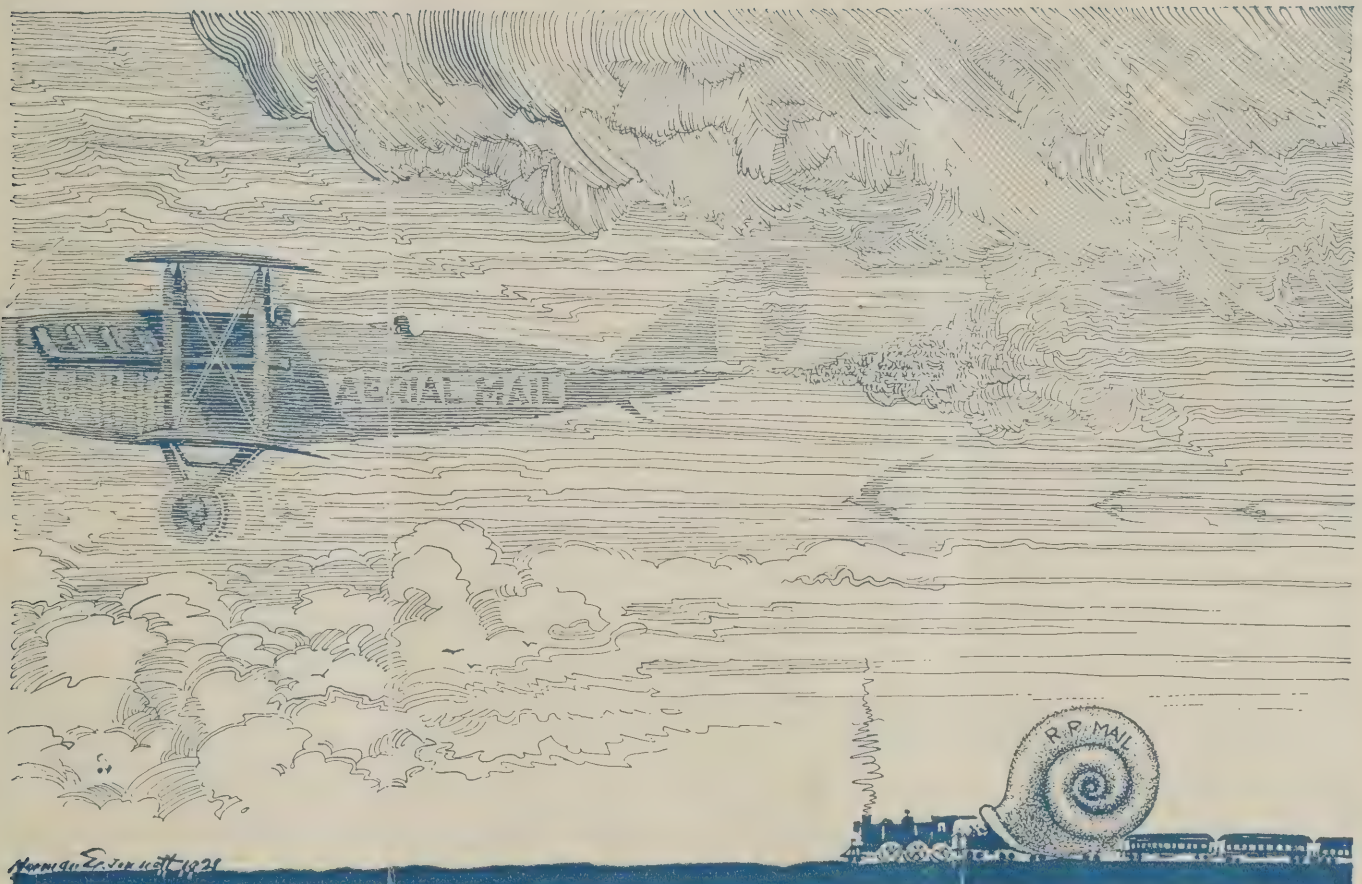
THREE PLACE BIPLANE—NEW DESIGN—STURDY AND LIGHT—HIGH LIFT THICK WING—ACCEPTED BY U. S. ARMY.—WATCH FOR OUR ANNOUNCEMENT.

THE PETREL

105
Engineering

AERIAL AGE WEEKLY

VOL. 14, No. 25 | FEBRUARY 27, 1922 | 10 CENTS A COPY



Now, Uncle Sam, If you had your say How would you send your Mail—
By Aeroplane and save a day, or Would you use the snail?

Reproduced from February 28, 1921, Aerial Age

The Curtiss Navy Torpedo Seaplane—Aero Club of America Contest Committee Doing Excellent Work

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office New York under the Act of March 3rd, 1879

SPECIAL OPPORTUNITY

To Secure a Copy of the

Textbook of Aero Engines

By E. H. SHERBONDY and G. DOUGLAS WARDROP

Together With One Year's Subscription to

AERIAL AGE WEEKLY

The Leading Technical and Trade Aeronautic Publication in America

The Textbook of Aero Engines has been prepared for the purpose of having in one volume the complete information concerning all modern types of aero engines and an up-to-the minute discussion of the principles of aero engine design and construction, so that the reader may be able to undertake comparative research without recourse to a formidable list of volumes and publications, which in any event could only supply him with more or less obsolete information.

AERIAL AGE WEEKLY discusses and describes all current developments in the aero engine field, so that with the Textbook and consecutive copies of AERIAL AGE the subscriber will possess a complete encyclopedia on the subject.

To AERIAL AGE WEEKLY
280 Madison Ave., New York

Please send me a copy of the Textbook of Aero Engines (regular price $10.00), and enter my name on your subscription list for one year (regular price $4.00). I desire to take advantage of securing both at the special price of $10.00, and am enclosing my check for that amount herewith.

Name .....

Address .....

February 27, 1922

AERIAL AGE WEEKLY

Vol. XIV, No. 25

TABLE OF CONTENTS

Aero Club of America Contest Committee Doing Excellent Work.... 583
The News of the Week..... 584
The Aircraft Trade Review..... 585
The Curtiss Navy Torpedo Seaplane 586
Marking Aerodromes..... 586
Mutual Influence of Wings and Propellers 588
Airships 590
Deterioration of Aeroplane Fabrics. 593
Naval and Military Aeronautics.... 594
Foreign News 595
Soaring Flight 596
Elementary Aeronautics and Model Notes 597
Aeronitis 598

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.
Printed in U. S. A.

Farman
SPEED-RANGE

The greatest problem in Aviation today is *slow flying*. Almost all airplanes are *fast enough*. Almost none are *slow enough*.

Speed-Range is the difference between the lowest flying speed and the highest flying speed of any particular airplane. If the lowest speed should be 40 m.p.h. and the highest speed 80 m.p.h. the *Speed-Range* of that airplane would be $\frac{80}{40}$ or 2.

Evidently, the higher the *Speed-Range*, the safer and more efficient the airplane.

The FARMAN two-seater is the *slowest flying Airplane in the World*, and it also has a high speed of almost 90 miles per hour.

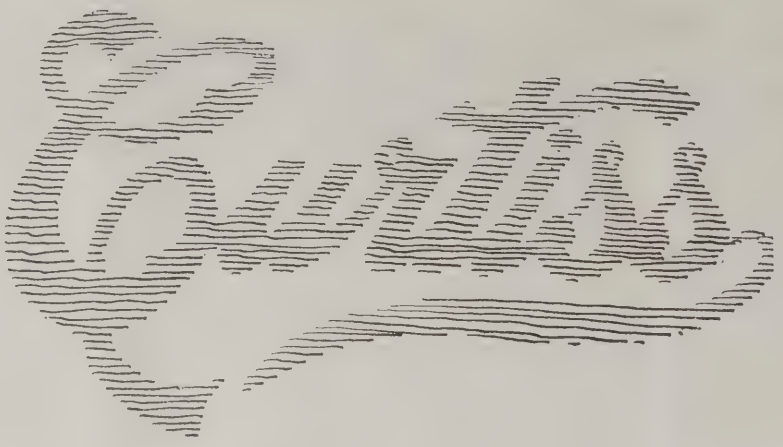
When you ride in the Farman you enjoy the most wonderful sense of comfort and security it is possible to realize in the air, because your Farman possesses *Speed-Range*, the most important factor in Aviation, to a superlative degree.

Two-seater Touring and Sport Model $4850.00.

Represented in America by

WALLACE KELLETT CO. Inc.

Widener Bldg. Philadelphia, Pa.



Announcing 1922 Price List

NEW PRODUCTION

	LIST PRICE
ORIOLE:	
With OX5 Motor	**$3000.00** F.O.B. Buffalo, New York
With K-6 Motor (1919)	**4400.00** F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	**4800.00** F.O.B. Buffalo, New York
SEAGULL:	
1919 K-6 Motor, dual stick control	**5200.00** F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	**5600.00** F.O.B. Garden City, L. I.
STANDARD:	
With C-6 or K-6 Motor	**3600.00** F.O.B. Garden City, L. I.
MOTORS:	
C-6 or K-6 (150 H.P.)	**3000.00** F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

JN's:	
JN4D with new OX5 Motor	**$2400.00** F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	**$1200.00 to 2200.00** F.O.B. Dallas, Texas
STANDARDS:	
With new OX5 Motor	**2000.00** F.O.B. Houston, Texas
With overhauled OX5 Motor	**1700.00** F.O.B. Houston, Texas
Without motor, rebuilt for OX5	**1100.00** F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	**1600.00** F.O.B. Garden City, L. I.
Without motor, as received from Government	**800.00** F.O.B. Houston, Texas
MOTORS:	
OX5 New	**800.00** F.O.B. Various concentration fields
OX5 Overhauled	**600.00** F.O.B. Various concentration fields
OX5 As received from Government	**500.00** F.O.B. Various concentration fields

NOTE: Where delivery is made from other than F.O.B. points, accrued transportation charges must be added.

WRITE FOR DETAILS IF INTERESTED IN BECOMING A DISTRIBUTOR OR DEALER, STATING TERRITORY DESIRED.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which Flying is consolidated

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., February 27, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, FEBRUARY 27, 1922 No. 25

Aero Club of America Contest Committee Doing Excellent Work

It has been apparent during the last few months that the Contest Committee of the Aero Club of America, under the able direction of Mr. Caleb S. Bragg, has been doing constructive work to insure a large measure of success for the aeronautic contests schedules for 1922. The following foreword to the Club's book on "Organization of Contests and Contest Rules," which will shortly be published, is an invitation to everyone interested in aviation meets to get behind the committee.

THE AERO CLUB'S POSITION IN AMERICAN AVIATION

The development of the science of aviation has progressed and will progress in proportion to the number of competitions, whether these competitions for air supremacy are world wars or national or international aviation meets. The development of the science will furthermore progress proportionately with the amount of money spent for competitions and the general trend of development will follow the conditions governing the most important competitions.

The Aero Club has encouraged, and will have to continue to encourage and assist in the development of the sceince of aviation. Through the generous donations of such men as Robert Collier, James Gordon Bennett, Ralph Pulitzer, Glenn Curtiss, and others, the Club has been able to encourage aeronautic development by offering valuable trophies and cash prizes for contests, trials and records, which bring forth new and improved aircraft. As the American member and representative of the F. A. I., the Club has assisted by promoting and conducting aviation meets, and by officiation at sanctioned meets.

However, the field of operations of the Club has broadened. As the uses to which the U. S. Government, the largest individual owner and user of aircraft in this country today, puts its aircraft are comparatively limited, being almost entirely confined to military operations, the manufacturer, finding no other market, is confining his energies to military development. Where is the moderate priced commercial plane?

Only as a National Association can the Aero Club detect the faint pulse of the Nation's desire for civil aviation and by properly digesting and combining these faint calls, and by collecting here and there the available subscriptions, introduce commercial aviation by competitions which will bring forth the needed commercial aeroplane, exploit its uses, produce the needed aerial highways with terminals, and proper legislation.

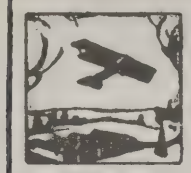
The development of the motor car and its usages has been effected without government support, receiving in the early stages its first stimulus through the sporting events of the Automobile Clubs of France, Great Britain, America, etc., passing then into the hands of such powerful organizations as the American Automobile Association, the Automobile Chamber of Commerce, and the Society of Automotive Engineers.

Today, the Aero Club is in the transitionary age, passing from a Club to an Association. As a Club it is still fostered by the government and called upon by the inventor and manufacturer, but the nation-wide interest in aviation has started and brought within the Club the nucleus of an Association.

Fully cognizant of these conditions, the Contest Committee has published this book in keeping with the plan for broadening the field of its operations. Through the election of associate members the Contest Committee will have representation at all aviation centers and will be able to direct all aviation meets, thereby increasing their value, not only as aeronautical events, but as direct contributions to aviation, by taking advantage of:

1. Public interest—
   (a) To make the people more intelligent supporters of aviation.
   (b) To increase the Asssociation's membership.
2. Official interest—
   (a) To invite Congressmen, Senators, state and municipal officials in order that they may witness the interest in aviation of the people of their states and thereby become more friendly towards legislation and appropriations for aviation.
3. Publicity—
   (a) To urge the press to give *less* prominence to stories of accidents and all "dare-devil" flying.
   (b) To urge and assist in the publication of stories bringing out the real merits of aircraft and their usages.
   (c) To bring before the capitalist the extent of public demand for aviation, thereby inducing him to invest in aeronautical development.
4. Prize money, and awarding it for events which will—
   (a) Stimulate the development of aircraft.
   (b) Exploit the usages of aircraft.
   (c) Perfect the art of flying.

The Contest Committee believe that any promoter having this knowledge of the aims and position of the Club, also the list of owners of aircraft now being compiled for publication, can prepare from the various aeronautical events described in the pages that follow, a program for an aviation meet which will not only be best adapted to the number and types of planes in any territory, but also in keeping with the policies of the Club.



The News of the Week



Aeronautical Problems Laid Before Chamber of Commerce of the United States

The Aeronautical Chamber of Commerce, in co-operation with the National Aircraft Underwriters Association, has been in close touch with the Chamber of Commerce of the United States. At the last General Meeting of the Chamber of Commerce of the United States at Atlantic City, aeronautical resolutions were presented at the instance of the National Aircraft Underwriters Association. We are now advised by the Chamber of Commerce of the United States that these resolutions have been recommended to the National Directors for favorable consideration. The report follows:

"The Department of Transportation and Communication has transmitted to the Board of Directors for its consideration a number of recommendations in connection with Aeronautic legislation. The Department Committee believes that Aviation is a national American institution, in origin and principle, and should continue as such. In practical development commercial aeronautics is now suffering from the results of war-time specialization and over-production. Through lack of legal and economic status it is not receiving the practical encouragement it deserves, not only as a most powerful arm of quick national defense, but also as a new transportation agency of great potentiality. Properly developed and articulated with present transportation systems this new agency can become a most valuable addition to the Nation's specialized carrier capacity in peace as well as in war. Recent hard experience in hurriedly training an adequate flying corps emphasizes the great need of a sufficient reserve available for any national emergency. At present, nation-wide regulative legislation is greatly needed, not only for the ordinary needs of public safety, but also to establish the legal status and responsibilities of air transport in national and international business. Canada, Australia and European nations have already provided such legislation. Without practical encouragement, commercial aeronautics in America will continue to lag behind foreign development to such an extent as to constitute a menace to future security and to delay fatally that essential commercial development in which America should rightly stand first.

"Therefore the Committee has recommended that the Board of Directors consider favorably the resolutions presented to the Ninth Annual Meeting by the National Aircraft Underwriters' Association, urging immediate support of legislation providing for an appropriate aeronautical code. Such legislation should be broadly conceived in the nature of an enabling act providing for the adoption, enforcement and the improvement from time to time of the Aeronautical code under proper government authorization created by the Act.

"That the Directors advocate the creation of a Bureau within the Department of Commerce for the development and regulation of commercial air transport operations in interstate and foreign commerce; intrastate operations and legislation to conform as nearly thereto as possible.

"That the Directors authorize such timely public utterances by the Department and Executives as can be made through the proper channels with the object of encouraging the early consideration of this essential aeronautical legislation."

Aviation Executives Discuss Development Work

Aircraft executives of aeronautical companies in the vicinity of New York City were addressed by Col. Charles De Lano Hine, recently assistant to the President of the Erie Railroad and a railroad man of many years' experience, at their semi-monthly luncheon held at the Cafe Boulevard, New York, this noon.

Col. Hine, who is one of the old railroad pioneers and who started in that industry as a brakeman, was introduced to the executives by R. R. Blythe, Chairman of the Luncheon and who is Aviation Manager of the firm of Johnson and Higgins.

"The aeronautical industry, which is still in its pioneering stage, does not seem to have half as many difficulties as did the old railroad pioneers," said Col. Hine. "You have no road beds to construct and maintain, and mountains and rivers to your industry are mere incidents. In the early days of railroading the first locomotive on the Baltimore and Ohio Railroad was placed in competition with a team of horses. Each pulled the same kind of car. The horses won. The railroad pioneers were looked upon by the general public as a curiosity, a somewhat similar condition existing today in the aeronautical industry. Faith and the determination to conquer put over the railroads and the same thing will put over commercial aviation."

Col. Hine praised the work already done in aviation and prophesied a brilliant future.

The luncheon was well attended, among those present being J. K. Robinson, Jr., Wm. B. Lebherz, John M. Larsen, T. Kramer, R. B. C. Noorduyn, G. C. Peterson, H. A. Bruno, W. K. Makin, A. P. Leoning, S. M. Fairchild, E. L. Young, Luther K. Bell, Howard Mingos, Augustus Post, Ralph Upson, Charles H. Colvin and E. Ely.

Meeting to Discuss Aviation Law

There will be a joint meeting of the Special Aviation Branch of the Committee on Uniform State Laws, with the Aviation Committee of the American Bar Association, in Washington, on February 25th, to discuss the requirements of aviation law. It is proposed to have this an open meeting so that those interested in the subject of uniform and comprehensive aviation law may be present.

Philadelphia Club Annual Meeting

At the annual meeting of the Aero Club of Pennsylvania, held at the Engineers' Club, Philadelphia, evening of January 21st, the following officers were elected: Joseph A. Steinmetz, president; W. H. Sheahan, 1st vice-president; Henry F. Bamberger, 2nd vice-president; George S. Gassner, secretary and treasurer.

Owing to the absence of President Steinmetz, the election of directors was postponed until the February meeting.

The following committees were appointed to serve for the year 1922, the first named member to act as chairman: House committee: Messrs. Bamberger, Spence and Truscott. Grounds committee: Messrs. Ireland, Hower, Kellett and Hall. Library committee: Messrs. Steinmetz, Gassner, Clarke, Leahy and Sheahan. Reception committee: Messrs. Steinmetz, Gassner and Huyette. Contest committee: Messrs. Hower, Ireland, Kellett, Leahy, Spence, Truscott and Miller. Program committee: Messrs. Steinmetz, Hower and Sheahan. Technical committee: Messrs. Clarke, Armstrong, Brownback, Philips, Bliss and Miller. Balloon committee: Messrs. Eldridge, Gassner and Wynne. Auditing committee: Bamberger and Spence.

The following special committees will also be appointed with the first named member to act as chairman: Aviation meets: Messrs. Ireland, Hower, Kellett and Hall. Models and Boy Scout work: Messrs. Owens, Conrow and Pratt. Military aviation: Commander Richardson, Commander Westervelt and Captain Willoughby. Press: Messrs. Gassner, Bamberger, Steinmetz and Sheahan. Membership: Messrs. Spence, Ireland and Hower. Official Photographer, Sheahan. Flight Observers (appointed by the Aero Club of America). Messrs. Steinmetz, Sheahan and Wynne.

Corsicana Flying Meet

A flying meet was held at Corsicana, Texas on February 24 and 25 and an excellent program was staged by the Western Flying Club. The events were under the auspices of the American Legion.

Prevention of Accidents

Arthur Halsted, associate engineer of the Bureau of Standards, delivered an illustrated lecture on "Prevention of Accidents in Aviation" before the Engineers Club of Philadelphia on February 21. A large delegation of members of the Aero Club of Pennsylvania attended the lecture.

Will Test Dirigible for Flight to Pacific

Washington—Army air service officials are at work on plans for long distance flights of the 600 foot dirigible Roma as soon as warm weather permits. The ship has been equipped with Liberty engines since her trip from Langley Field to Washington. Trial flights with the new engines probably will be made late this week.

Within two or three months air service officials expect to fly the Roma from Langley Field to New York and to operate her between New York and Chicago as a test of the commercial possibilities of the dirigibles of the Zeppelin type.

If the results of these tests warrant it is expected that a transcontinental flight to San Francisco from New York will be attempted. The probable route across the continent will be by way of St. Louis and Southern points in order to avoid the necessity of climbing to high altitudes in crossing the Rocky Mountains and the Sierra Nevadas to reach the Pacific coast.

The AIRCRAFT TRADE REVIEW

Philadelphia C. of C. Appoints Aviation Committee

The Chamber of Commerce of Philadelphia has appointed an aviation committee for the current year and the following gentlemen have accepted:

S. B. Eckert, Chairman; Charles J. Biddle, Albert M. Cohen, Robert Glendinning, Stephen H. Noyes. Hollinshead N. Taylor, Joseph A. Steinmetz.

It is intended that this group shall be invited regularly to all the Aero Club of Pennsylvania meetings so a liaison may be established between all control groups on aviation matters in Philadelphia.

Senate Passes Air Bureau Bill

Washington—The Wadsworth bill creating a Bureau of Civil Aeronautics in the Department of Commerce was passed February fourteen by the Senate and sent to the House. An amendment requiring the bureau to accept licenses issued the air pilots by States on an equality with Federal licenses was eliminated.

Senator Wadsworth predicted that "our children and most certainly our grandchildren are going to ride as freely through the air as we now ride about in flivvers."

Allies Hold Up Cargo of German Planes

Copenhagen—The *Extrabladet* says it learns that officials of the Entente to-day placed an embargo on a shipload of German aeroplanes which it was officially reported had been sold to China, but which was brought by an Italian steamship to Fredericia, on the southeast coast of Jutland.

The newspaper adds that the suspicions of the Entente officials were aroused by the presence of German aviators among the crew of the vessel.

New Air Transport Company Considered

Colonel John A. Jordan, Chief of Construction of the United States Air Mail Service, told a group of men interested in aeronautical development at the Hotel Biltmore, New York, on February 17, that a permanent commercial air mail and merchandise service between New York and Chicago was feasible.

"I believe we have reached the maximum speed with proper regard to safety on railways," Colonel Jordan said. "Then, to meet the demand for saving time, we must navigate the air. It is the only way, and, speed considered, the aeroplane is the safest means of transportation ever known."

Congressman Halvar Steenerson of Minnesota, Chairman of the House Committee on Post Offices and Post Roads, the author of a bill before the committee for the carrying of mail by aircraft on a contract basis, said that Congress undoubtedly would renew an appropriation next year for an air mail service between New York and San Francisco.

The meeting was called for the purpose of discussing a commercial air mail service under Congressman Steenerson's proposed bill. A number of bankers, including Lee Olwell, representing the National City Bank, attended the meeting. Aeronautical experts agreed that the plan could be worked out successfully.

1,000-H.P. Aeroplane Engine

London—A new aeroplane engine which, though weighing only 2,200 pounds, develops 1,000 horsepower has been constructed by D. Napier & Son, Ltd. It was exhibited February 16 to a large gathering of aviation experts. A locomotive engine developing the same horsepower would weigh 147,840 pounds without fuel or water.

This new engine is to be fitted to a specially designed aeroplane now being built for the Air Ministry for the coming trials. These are considered to be of great importance and are awaited with keen interest.

Curtiss to Build 50 Martin Bombers

The War Department has awarded an order for fifty Martin bombers to the Curtiss Aeroplane & Motor Corp. of Garden City. The award was based on competitive bids, the Curtiss bid being the lowest.

This order is additional to the one for fifty Martin bombers placed by the War Department with the Curtiss company, which is under way. Thirty-five Martin bombers are under construction for the Air Service at the L.W.F. plant at College Point, L. I.

Miles City Endorses Air Mail

The Miles City Chamber of Commerce (Montana) at the recommendation of the Aero Miles City Club recently sent the following resolution to Congress:

BE IT KNOWN, that

WHEREAS, the United States Air Mail Service has shown such a remarkable efficiency in number of trips completed as against scheduled trips, and

WHEREAS, the data to be obtained from records of the operating of the Air Mail Service are the only authentic records along civil lines, and

WHEREAS, the United States Air Mail Service is not surpassed by any Aerial Transport Service in the World for efficiency, therefore,

BE IT RESOLVED, that this Chamber go on record as this day approving the appropriation for the Air Mail, recommended by The Director of the Budget, Mr. Dawes, for 1922, in order that the United States Air Mail Service be not discontinued, and

BE IT FURTHER RESOLVED, that a copy of such resolution be forwarded to the Representatives and Senators from this District and State, that the resolution be spread upon the minutes of the meeting, and that a copy be given to the press for publication.

MILES CITY CHAMBER
OF COMMERCE,
(Signed) John Whitney,
Secretary.

Aeronautics in Congress

The following memorandum covering consideration given to aeronautics in Congress has been prepared by the Aeronautical Chamber of Commerce:

Jan. 12. House. (H.R. 9859) Post Office Appropriation bill. Remarks concerning the elimination of the air mail appropriation. Mr. Sisson in the House speaks in favor of the appropriation.

Jan. 13. House. (H.R. 9859) Post Office Appropriation bill. Mr. Griffin speaks in favor of the Air Mail Service. Mr. Steenerson spoke in favor of a bill introduced by him which provides for letting air mail contracts to commercial companies by contract. Mr. Griffin speaks in opposition to this method. (Speech appeared in record of Jan. 30th.)

Jan. 21. House. Mr. Cullen introduces the petition of the Aero Club of America urging support of the Wadsworth bill, S. 2815; to the Committee on Interstate and Foreign Commerce.

Jan. 26. Senate. Mr. Wadsworth (S. 3076) to create a bureau of aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce and for other purposes; to the Committee on Commerce.

Jan. 27. House. Independent Appropriation bill. (H.R. 9981) Appropriation of $200,000 for National Advisory Committee for Aeronautics approved.

Jan. 30. Senate. Mr. Jones of Washington, from the Committee on Commerce to which was referred the bill (S. 3076) to create a Bureau of Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce and for other purposes, reported it with amendments and submitted a report (No. 460) thereon.

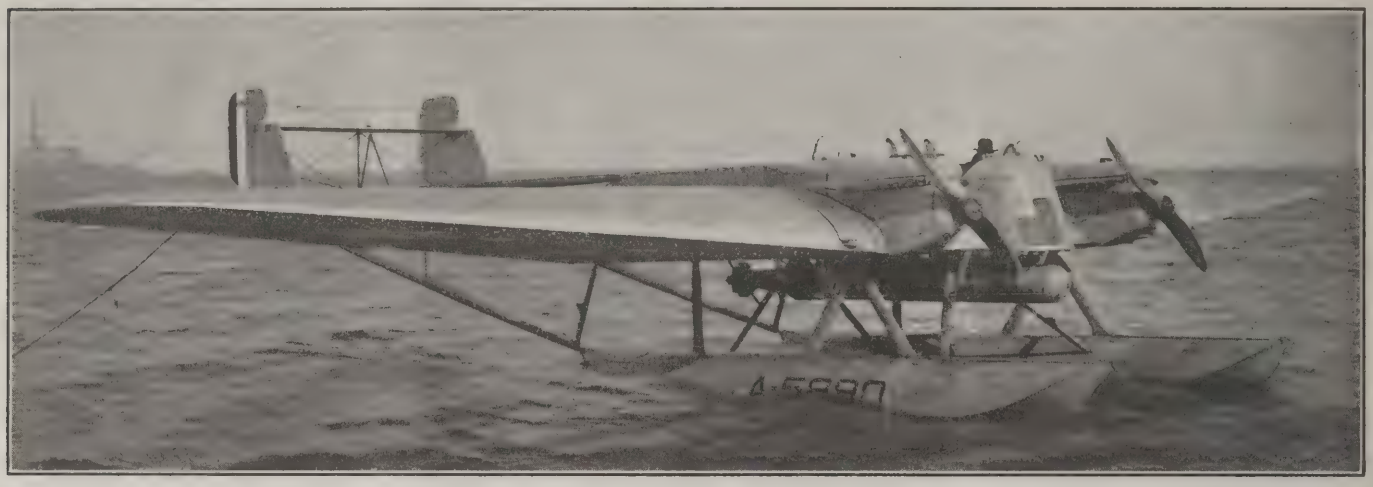
Senate. Mr. Smoot a bill (S. 3084) to authorize and provide for the payment of the amounts expended in the construction of hangars and the maintenance of flying fields for the use of the air mail service of the Post Office Department; to the Committee on Post Offices and Post Roads.

Jan. 30. House. Mr. Green in course of remarks re: Shipping Board states that he thinks the Leviathan would make an excellent aeroplane carrier.

Jan. 31. Senate. Mr. Jones of Washington, gives notice that when present unfinished business is disposed of that he would ask that the Senate proceed to the consideration of Senate Bill 3076, authorizing the creation of a Bureau of Aeronautics in the Department of Commerce.

House. Mr. Hicks makes a long speech pointing out the need of regulation of aviation.

Feb. 1. House. Executive Communications. A letter from the Secretary of the Navy transmitting a tentative draft of a bill to equalize the pay of the aviation officers of the Navy and Marine Corps, with that of officers of the Army; to the committee on Naval Affairs.



THE CURTISS NAVY TORPEDO SEAPLANE

THE Curtiss Aeroplane & Motor Corporation of Garden City, L. I., recently made delivery by air to Anacostia Naval Air Station, Washington, D. C., of a new type torpedo seaplane. This is an advanced type of seaplane designed to carry a standard Navy 1650 lb. torpedo or an equivalent load of aerial bombs.

The machine if of cantilever monoplane construction with two Curtiss CD-12 400 H.P. engines mounted in the leading edge of the wings at each side of the pilot's cockpit. The motors are cooled by Lamblin Type radiators mounted underneath the wings in the slipstream of the propellers. The gas tanks, radio equipment and rear cockpit are in the center section of the wing.

The framework of the machine is wood and the wing covering is fabric. The wings taper both in chord and camber from the center section to the tips. The center section is of uniform chord and depth and is 15 ft. in span. The maximum chord is 16 ft. and the total span of the machine is 65 ft. This design of ship is particularly adapted to metal construction and it is expected that future models of the CT will be constructed of this material.

The landing gear consists of two floats 25 ft. long, one under each motor. There is no attachment between the floats, which leaves all the space in under the center section free for the transporting of torpedos or bombs. The tail is of biplane construction, with twin rudders, and is supported by four spars, two of which extend from the rear end of the pontoons and two from the rear end of a fin which terminates even with and above the trailing edge of the center section.

The high speed of this machine is 112 miles per hour, and it has a ceiling of 1,300 ft. with a useful load of 3,800 lbs.

General Specifications

Wing Arrangement	Monoplane
Crew	2
Span	65 ft.
Length overall	52 ft.
Height overall	15 ft. 11 in.
Total area	830 sq. ft.
Useful load	3,674 lbs.
Gasoline capacity	216 gal.
Range wide open	3 hrs.
Max. indicated speed at sea level, 112 M.P.H. over speed course	
Motors—2 Curtiss	C-D-12
H.P. at 2,000 R. P. M.	400 each
Gasoline consumption	5 per H.P. hour

MARKING AERODROMES*

By P. JAMES

NECESSITY of adopting for all aviation fields, civil or military, a single system of markers for giving the direction for starting and landing (with an automatic indicator of the direction of the wind) and of indicating the good part of the field.

Aviation accidents are very rare in full flight. Statistics show that 70% of the accidents are at the airdrome. They are almost always due to a disregard of two fundamental rules for piloting near the ground.

1. Start and land on good ground with a sufficient distance in front free from obstacles.

2. Start and land facing the wind and avoid turning too near the ground.

The methods commonly employed for indicating the direction of the wind often give false indications or are not sufficiently visible. Aviation fields are seldom defined clearly enough so that the markers are visible from above. The fields of Villacoublay and Bourget are exceptions. By giving pilots the means of knowing exactly the direction of the wind and the good portions of the field, we can eliminate at a single stroke nearly all airdrome accidents.

Methods hitherto employed. During the war, there was no general plan for marking military aviation fields and each commander, following his own initiative, made more or less satisfactory arrangements on his own field. We had to deplore the loss of excellent men and a large quantity of material, for the lack of rigid instructions and a systematic marking of the fields. The three methods of marking were:

Cloth T on the ground;
Cloth wind sleeves;
Smoke.

1. *The Cloth T* presents theoretically two advantages. It is plainly visible from the air and can be placed, for a given direction of the wind, on the most favorable part of the field, the part which has in front of it, in the direction indicated by the T, the best and longest strip of land.

In practice, since the T must be moved by hand, it does not always indicate the right direction and has therefore been gradually abandoned. Where it is still used, it generally indicates the location of the hangars.

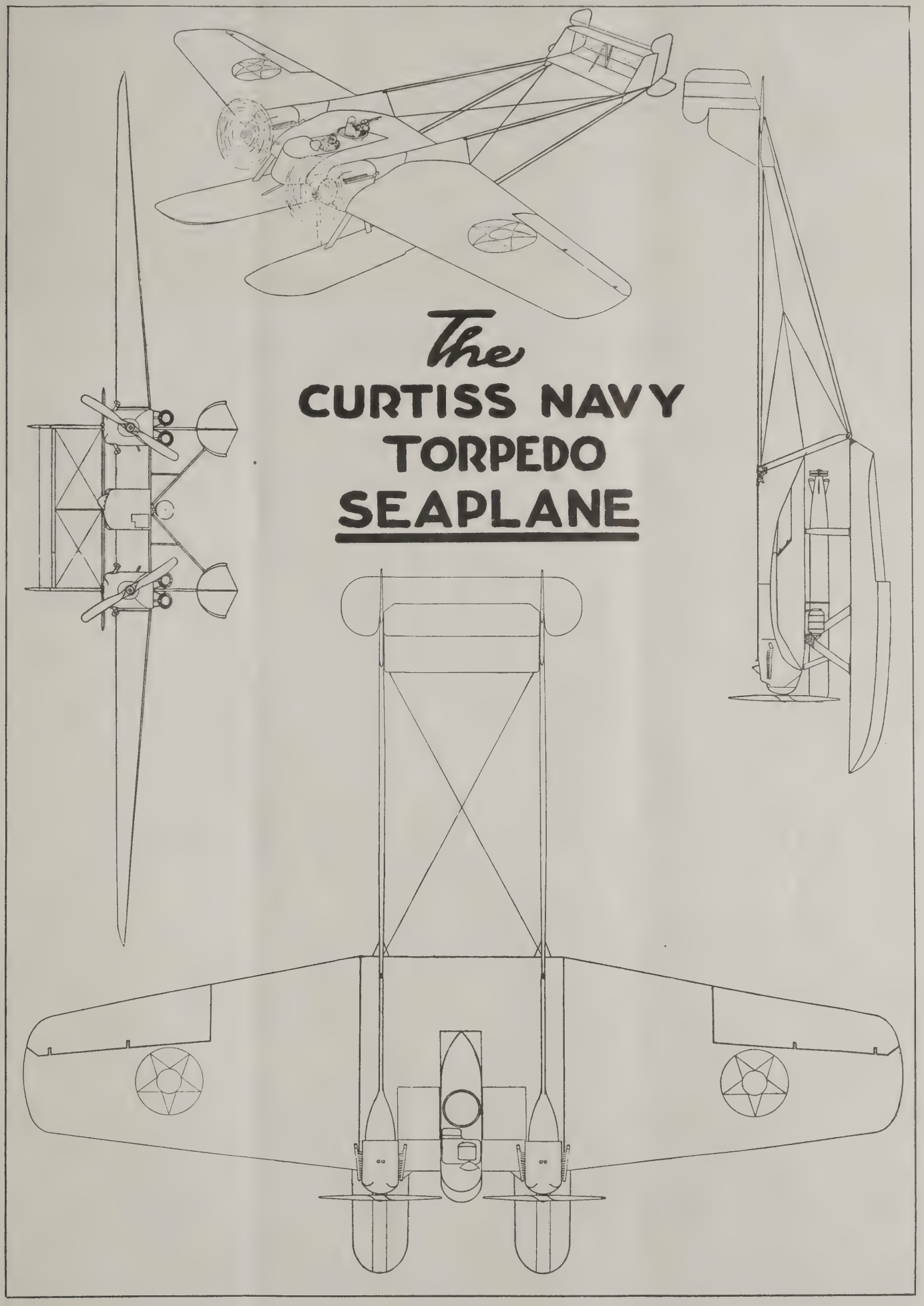
2. *Cloth sleeves.*—These turn with the wind and at least have the advantage of not giving false indications. But they are not very visible, cling to the pole when the wind is weak and do not really indicate the direction for starting and landing, but rather two opposite directions (from which and toward which the wind blows) which may easily be mistaken. Lastly, the cloth is worn out quite quickly by the wind.

3. *Smoke.*—This has the advantage of being visible. It can moreover be produced in the part of the field to be utilized for starting and landing. It has the disadvantage of requiring the continual presence of a man to keep the fire going and to move it to the suitable locality.

Remark.—All these methods become valueless at night.

It is superfluous to dwell longer on the defects of these methods which seemed quite satisfactory during the war, when a few human lives counted but little and when aviation accidents passed unnoticed

* From Premier Congrès Internationale de la Navigation Aérienne, Paris, November, 1921. Vol. II, pp. 115-118.



The CURTISS NAVY TORPEDO SEAPLANE

among all the other losses.

It is quite different today, when the main obstacle to the development of aerial transportation is the danger, which it is most urgent to diminish in every possible way.

The adoption of a mechanical indicator showing automatically the direction from which the wind comes is therefore of prime importance.

The desirability of providing all aviation fields, both civil and military, with one and the same type is no less evident.

Methods of Marking Now Proposed

After the armistice this matter was taken up by the Technical Section of Aviation, to which we suggested certain methods of marking.

At the same time we carried out a series of experiments for the purpose of determining the shapes and colors most visible from the air, and therefore most suitable for marking.

Our experiments were performed at Villacoublay by means of silhouettes of exactly the same surface area, which were all observed simultaneously by aviators at different altitudes.

The best shape for indicating direction was found to be a T and the next best was an arrow with a broad head (approaching a T).

The most visible color on all backgrounds is white, then bright red. Borders and bars, designed to differentiate the silhouette from snow, diminished its visibility by dividing up the surface. The visibility of the T is improved by putting cinders under it.

We recommend an automatic indicator in the form of a T turning with the wind.

We have seen that it is necessary to show the pilots:

1. The direction for starting and landing;

2. The part of the field which has in front of it, in the direction of the wind, the longest strip of ground free from obstacles.

The automatic T we recommend gives these indications accurately. In fact:

1. It is clearly visible up to 1,000 or 1,500 meters, according to the state of the atmosphere, an altitude great enough to enable any pilot to land at the right spot.

2. It turns automatically with the wind and constantly indicates the direction for starting and landing.

3. A sufficient number of them, placed on the perimeter of the field, indicate the part of the field it is dangerous to leave.

4. When placed on the perimeter of the field, there is, for every direction of the wind, one T which has in front of it the longest possible strip of good ground inside the limits.

5. By night, the indicators can be rendered luminous and furnish the same indications as by day.

6. Being mounted on ball bearings, they are very sensitive.

7. The simplicity and inexpensiveness of these devices make it possible to equip all fields liberally with them. It must not be forgotten that at the present time any aeroplane in flying order represents a value of 250,000 to 300,000 francs. The equipment of an aviation field with these T's cost less than a single serious accident.

Construction of the Automatic T

This device, simple in appearance, presents some difficulties in construction. It has a metal frame for withstanding the very violent winds which sometimes prevail on the airdromes, and is mounted on ball bearings, in order to increase its sensitiveness to light winds and remove all cause for jamming.

The difficulty lies in giving it a nearly constant sensitiveness to winds of every variable intensity, or, in other words, to make it sufficiently sensitive to a feeble wind, without danger of its becoming deranged in a strong wind.

The first ones made were continually in motion, due to local gusts of wind, often producing oscillations of great magnitude which were very disturbing for the aviators and which might lead to false deductions in regard to the true direction of the wind.

We were led to try a damping device consisting of paddles moving in a viscous and non-congealable liquid. The continual oscillations of the T are thus prevented and the latter only indicates the mean direction of the wind, instead of responding to every local gust. This principle has been applied to a certain number of T's constructed for the Aerial Navigation Service with entirely satisfactory results.

Dimensions of T

The dimensions adopted by the Aerial Navigation Service seem to be satisfactory. The T has a length of 7 meters, a span of 6 meters and a width of 1.2 meters.

For the sake of economy, only one T has thus far been installed on each field, the rest of the field being marked by red and white air-sleeves.

Height of T Above Ground

In our opinion, the T should be 2 or 3 meters above the ground, a height at which it is necessary to have a head wind in landing.

(*Translated by the National Advisory Committee for Aeronautics.*)

Aircraft Distress Signals

Mariners and others are notified that when any aircraft is in distress and requires assistance, the following shall be the signals displayed by her, either together or separately:

I. The International Signal "S O S" by means of visual or wireless telegraphy.

II. The International Code Signal of Distress indicated by N. C.

III. The Distant Signal, consisting of a square flag having above or below it a ball or anything resembling a ball.

IV. A continuous sounding with any sound apparatus.

V. A signal consisting of a succession of *white* Very's lights fired at short intervals.

VI. A *white* flare from which at intervals of about 3 seconds a *white* light is ejected into the air.

The above signals are subject to such modification as shall be published from time to time.

MUTUAL INFLUENCE OF WINGS AND PROPELLERS*

By L. PRANDTL

IN the experiments, use was made of the arrangement shown in Fig. 1. The aerofoil had the wing section No. 436, with a span of 960 mm., and a chord of 160 mm. The propeller had a diameter of 265 mm., and was mounted on the end of an adjustable shaft, which in turn was mounted on a floating frame, and was driven, by means of a belt, by an electric motor located outside the air current. The parts located in the air current (namely, the frame with the propeller shaft bearings and the belt pulley) were provided with a streamlined shield. The length of the unsupported shaft from the propeller to the bearing was 1200 mm. In the experiments with the propeller behind the aerofoil, a correspondingly shorter shaft was employed. The mounting of the propeller on the floating frame made it possible to determine the propeller thrust. With this arrangement, it was not possible to incline the propeller axis in the direction corresponding to the change in the angle of attack of the wing. The propeller shaft remained constantly in the direction of the air current, while the aerofoil was inclined at various angles by turning it about the point D.

In all the experiments, a wind speed of about 20 m/s, and a propeller speed of about 7000 r.p.m. were constantly maintained. The tip speed of the propeller was consequently about 97 m/s, and its ratio to the wind speed 4.86 to 1.

The aerofoil and propeller were first tested separately (Tables 1 and 2) and hence without mutual influence.

Table 1.

Aerofoil (960 x 160 mm.) alone.			(S = 0.153 sq. m.)
Angle of [illegible]	C_L	C_D	C_M

Table 2.

Propeller (dia. 265 mm.) alone. 7000 r.p.m.

Impact pressure q (kg/m²)

Thrust T (kg.)

The following cases were then tried:

1. Propeller in front of aerofoil—
   - (a) Propeller axis below aerofoil,
   - (b) " " above "
2. Propeller behind aerofoil—
   - (a) Propeller axis below aerofoil,
   - (b) " " coincident with chord ($\alpha = 0°$),
   - (c) " " above aerofoil.

The lift, drag and moment of the aerofoil were measured at various angles of attack. The propeller thrust was also measured. The measurements were made with the propeller shaft at different distances from the aerofoil. They are designated by the distance a of the propeller axis from the chord, with $\alpha = 0°$. The distance d between the propeller

* Extracted from the First Report of the Göttingen Aerodynamic Laboratory, Chap. IV, Sec. 6, pp. 112-118, by the National Advisory Committee for Aeronautics.

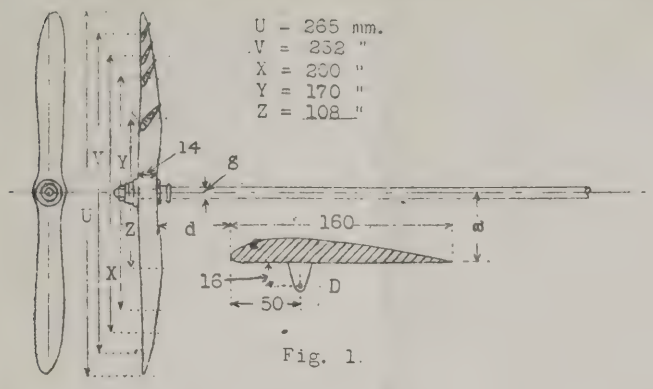


Fig. 1.

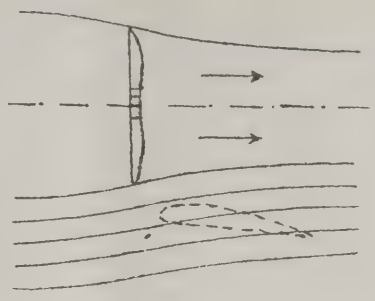


Fig. 2

and the aerofoil was measured in case No. 1 from the rear end of the propeller hub to the leading edge of the aerofoil, and in case No. 2 from the trailing edge of the aerofoil to the front end of the propeller hub. This distance averaged 50 mm., but varied in the different experiments. The exact distances are given in the corresponding tables. In the graphical representation of the results, the polar curve for the case when the propeller has no effect ($\alpha = \omega$) is always given as a dashed line so as to have a better comparison. The propeller thrust T is expressed by the coefficient C_T and is plotted from the origin toward the left as a function of the lift. C_T is defined by

$$T = C_T S q$$

in which S = surface area of aerofoil. From this equation the propeller-thrust coefficient C_T is obtained in a manner analogous to that for finding the drag coefficient C_D. This is done in order to obtain the direct comparison of C_T and C_D. On the diagrams the unit of measurement for C_T is twice as large as for C_D and the scale for C_T is reduced, beginning with $C_T = 0.15$. The corresponding thrust coefficient C_T of the propeller alone is likewise always traced with dashes. The propeller thrust was taken quite large with reference to the drag of the aerofoil, in order to accentuate the effect. That such was the case is evident from the following estimation. If we assume that $\alpha = 6^\circ$ (Compare the dashed polar curve in Fig. 3) and that the structural drag of the aeroplane equals the wing drag, we obtain a total drag corresponding to a drag coefficient $C_D = 0.10$. On the other hand, the average propeller thrust is $C_T = 0.18$, hence considerably greater than the drag, so that the existing relations correspond to steep climbing flight.

In judging the results, it is well to distinguish two kinds of influences, one due to variations in velocity, and the other due to variations in direction of the air current. The propeller is affected mainly by variations in the inflow velocity due to the wing. The wing is also subjected to slight changes in the direction of the air flow, which noticeably affect the drag. This is especially apparent when the aerofoil is outside the slip stream. Taking, for example, the arrangement shown in Fig. 2, it is seen that an ascending air current is developed, which can noticeably affect the drag, even though it acts on only a portion of the aerofoil. If the propeller is in front of and its axis lies below the aerofoil (Fig. 3, Tables 3-5), the drag is greater than in the undisturbed air current. At small distances from the propeller axis, where the aerofoil divides the slip stream, the drag increase is due to the greater air

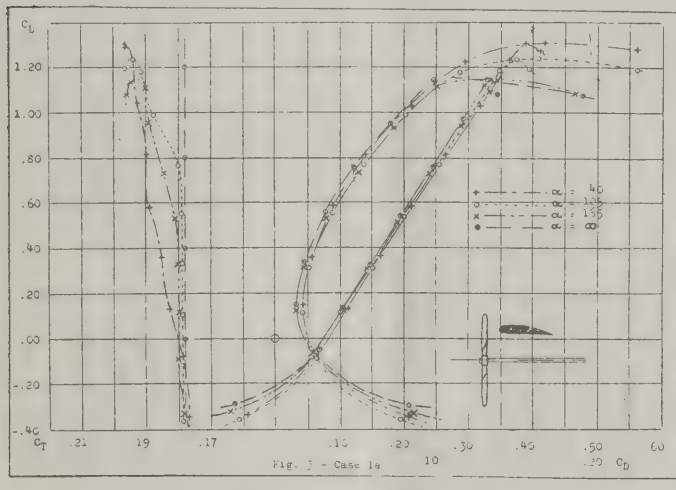


Fig. 3 - Case 1a

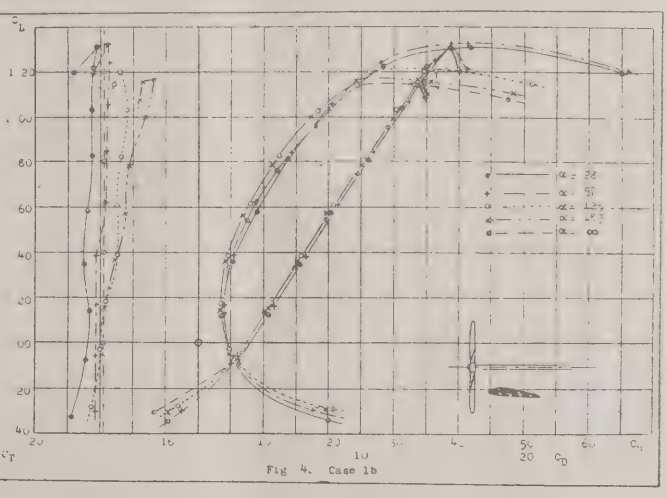


Fig 4. Case 1b

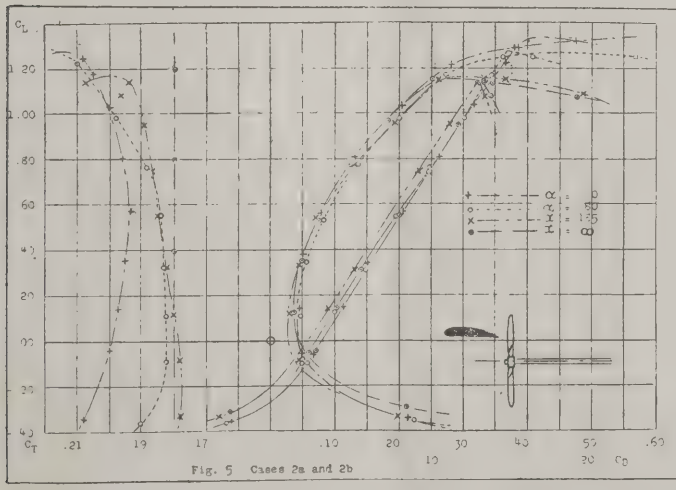


Fig. 5 Cases 2a and 2b

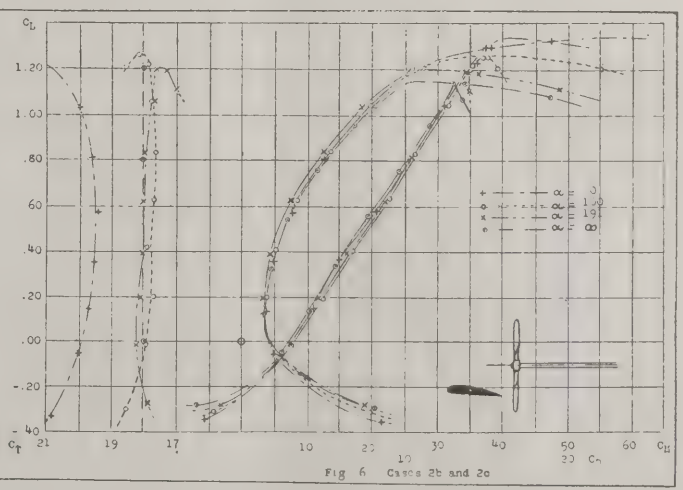


Fig 6 Cases 2b and 2c

speed. If the distance a is increased so much that the aerofoil lies outside the slip stream, the drag will be considerably increased by the descending air current. The air velocity is less close to the lower side of the aerofoil than at a greater distance and decreases as the lift increases. The propeller, working on the lower side, develops a greater thrust, due to the reduced inflow velocity. In the case under consideration, the thrust is greater than for the propeller alone and increases with increasing angle of attack. If the propeller axis is located on the upper side, the conditions are reversed (Fig. 4, Tables 6-9). Here the propeller works in a swifter air current and consequently develops less thrust; just so much less, in fact, as the lift of the aerofoil is greater. Only when the axis of the propeller is very close to the aerofoil (a = 28 mm.), is the thrust increased. Here the propeller works in a current with a slower mean velocity, mainly because it lies partly below the aerofoil, where the drag is greater. In the other cases the drag is diminished, in comparison with the undisturbed aerofoil, as a result of the ascending air current generated by the propeller (Fig. 2).

With the propeller behind the aerofoil (Figs. 5 and 6, Tables 10-14), the case was tried in which the propeller axis lay in the chord of the aerofoil,, with $\alpha = 0$. Here the propeller disk lay partly in the wake of the aerofoil. Since the air velocity was less in this vicinity, the mean velocity of the propeller inflow was less than the velocity of the undisturbed air current and the propeller thrust was correspondingly greater. Since the size of the wake is closely related to the drag of the aerofoil, it is evident that the propeller thrust depends on the aerofoil drag, especially with large positive and negative angles of attack. The influence of the propeller on the aerofoil is here similar to what it is with the propeller in front of the aerofoil. The variations in the thrust and polar curves can be explained in like manner, when the propeller axis is moved toward either the upper or lower side of the aerofoil. There was a marked decrease in drag in the experiment when the propeller axis was the farthest (a = 191 mm.) above the aerofoil. This was due to the ascending air current at that place. The variations in the aerofoil moment (about its leading edge), due to the influence of the propeller, were very small in all the cases, as shown by the moment curves.

AIRSHIPS

By MAJOR G. H. SCOTT, C.B.E., A.F.C., A.M.I. Mech. E.

(Paper read before the British Air Conference, February, 1922)

Introduction

OWING to the incentive of the war the airship has been brought to that state of development where it may justly be said to take its place amongst the useful inventions of the world. Like all other engineering achievements which have reached such a stage there can be no question of it standing still; it is certain great efforts will be made to establish it as a means of long distance transport, and to utilize it for defense purposes.

British airships are in a peculiar position—the British public really know little about their great possibilities as, although our existing airships are capable of carrying out flights of three to four days, it has been impossible to demonstrate the commercial value and possibilities of this performance as no ground organization is available outside Great Britain. The public in this country have seen nothing but the irregular, although long, flights carried out by our ships.

The German public, on the other hand, are aware of the possibilities of the airship, as they have had practical demonstration of airships flying regularly on fixed routes for commercial purposes.

The airship position in this country has now reached a critical stage, and I hope to show you that issues of vital importance to the Empire depend upon the steps which we take now. As I have said, there can be no doubt that the world will continue the development of the airship and eventually airships will be flying commercially on all the main world routes. Personally, for reasons which I give later, I hold the view that if a move is not made now, one will be forced on us at no distant date, probably within two years.

Foreign Airship Activities

My reasons for thinking that if a move is not made now by this country, it will have to be made within two years are based not on any revolutionary improvements in airship design (I state later that the present-day airship is in my opinion capable of founding certain important services), but on the airship position in other countries. Briefly, the activities, known to be taking place, are as follows:

America

The United States Naval Department have arranged with the Allies for the construction of an airship by Germany at the Zeppelin Works as part of America's share of aerial reparations. This ship, we may take for granted, will embody the latest features of airship design, and should be flying within twelve months. The United States Navy Department are also building in America the Z. R. 1, modelled on a German ship. The U. S. Army have recently purchased the Italian semi-rigid Roma, which is the largest airship of its type in the world, and have also in commission several smaller non-rigid airships.

With such a programme progress will be very rapid. A large base at Lakehurst has been erected; it has a shed with twice the floor space of anything in this country, capable of housing ships three to four times the size of any built to date. There are also several other bases in being and in use by the Army and Navy authorities, notably Langley Field.

It is also known that a powerful commercial combine exists in America today, with a view to running commercial airships, probably in the first instance trans-continental—the Atlantic being considered a later development.

I should like to quote from the United States National Advisory Committee for Aeronautics' Report for 1921:

> "Attention now being given to the development of types of airships to realize fully the advantages which the use of Helium would afford should be continued. Such development would give America advantages for purposes either of War or Commerce with which no other nation could successfully compete."

I think I have said enough to show that the United States means to develop the airship, and it must be remembered we shall have a practical demonstration of the capabilities of the modern airship within the next twelve months, when the ship Germany is building for America is flown across the Atlantic. On delivery of this ship in America a great incentive will be given to airship activity throughout the world.

France

The re-erection of three large sheds, which were taken from Germany under the eace Terms, is proceeding. These sheds are being erected, one near Paris, one near Marseilles and one in Algiers. These, together with the two existing bases at Maubeuge and Marseilles, will place France in a very strong position when she can finance the construction of ships (which undoubtedly is her present intention), both from an international traffic point of view and for the operation of an airship service from Paris to her principal colony.

Germany

There is abundant proof that the Germans are firm believers in the future of airships. They have, in various ways, managed to keep their technical staff together, and are still in a position, technically, to design and construct airships.

The latest move, and one which in my opinion will give them what may well turn out to be a commanding lead in airships, is the arrangement now being completed between Spanish commercial interests and Zeppelin interests to establish an airship service between Spain and the Argentine.

There is no reason why the first leg of this route, say to Las Palmas, should not be operating within 2 years from now in spite of the fact that a shed must be erected in Spain, and quite possibly in this time the service may have reached Brazil.

Italy

As I have already said, Italy recently constructed a 1¼ million cu. ft. semi-rigid which America has purchased. They are now engaged in building a still larger airship of this type which will have a range of about 4,000 to 5,000 miles. Italy also has under consideration a commercial airship service from Rome to her North African colony Tripoli.

From what I have just said you can estimate what the world airship position is likely to be within two years, and I leave it to you to decide whether this country could then continue to remain inactive without prejudicing the interests of the British Empire.

The Airship and Imperial Communications

As stated by the Dominion Prime Ministers at their Conference in London last summer and now universally recognized, the problem of speeding up Imperial communications is a matter of urgent and vital importance to the Empire. The employment of the fastest modern liners on Imperial routes would not achieve a saving of more than 15% to 20% on

present times of transit, and I believe I am right in saying that the cost of establishing such services would run into many millions and could never be operated economically.

To provide a real benefit we must use the air. I am a firm believer in the future of the commercial aeroplane but have talked over this matter with many aeroplane experts and they agree with me that a satisfactory system of aerial transport over the world can only be established by both airships and aeroplanes working together. They agree that the work between main terminals in each country can only be carried out by airship, these terminals being fed by aeroplanes. There is no doubt that a large amount of work has been and is being done as regards these aeroplane feeders, but the linking up of the main terminals is the first essential, and unless the airship is used for this purpose it is difficult to see how Imperial communications can be improved.

The cost of establishing airship services was very fully dealt with by the Imperial Air Communications Committee, but the fall in prices since that report was drawn up should enable considerable reductions to be made.

The Technical Position of the Modern British Airship

It is now necessary for me to refer briefly to the technical position of the airship today in order to demonstrate to you that it is capable of playing an immediate part in linking up the Dominions.

With the technical knowledge and experience at our disposal it can be affirmed with certainty that an airship can be built today whose performance in all directions can be established beforehand and which will not introduce any experimental and untried features.

In stating this, it is fitting perhaps to refer to the R-38 disaster, especially as I regret to see that statements are current in certain quarters that this accident goes to confirm the general conclusion that airships are not yet sufficiently developed to be commercially employed. It is only necessary to refer to the findings of the Service Court of Enquiry to show how wrong such a conclusion is. In the findings, it is shown that in order to outfly German military airships, a very high ceiling was necessary. This, of course, meant low factors of safety. The commercial airship does not require this high ceiling, and therefore the factors of safety can be considerably increased. Furthermore, the ship was designed some four years ago, when considerably less knowledge was at our disposal than to-day.

To form a conclusion that the airship is insufficiently developed for commercial purposes from the failure of such a ship as R-38 alone is to ignore the thousands of flights made by the German airships in all kinds of weather, to say nothing of the work of R-33 and R-34 and other British airships.

The airship I propose would have a capacity of 2,500,000 cubic feet, giving a gross lift of 75 tons and a useful lift for freight of 12 tons for non-stop journeys of 2,000 to 2,500 miles. This would enable 35 passengers and 7 tons of mail and other goods to be carried, without an intermediate stop, from England to Egypt. A journey of this distance could be completed in 50 hours or at a speed made good of 50 m.p.h. The hull would be of a rugged construction, built for a long life and low maintenance cost, and should last in continuous service for at least five years. The airship would be built with a factor of safety at least equal to that of R-33 and R-34, which showed themselves capable of standing up to the worst weather conditions both in flight and at the mooring mast.

During the last 12 months I have carefully examined the daily weather chart which covers the entire route between England and Egypt, and in my opinion there is no doubt that this first leg of the Imperial Air Route could be run with a regularity comparable to that of steamships, and in the time I have given above—50 hours. For the next step, Egypt to India, we have not at the moment the same detailed weather information, but there is nothing in the information at my disposal which would suggest any difficulty in maintaining an equal degree of regularity over this second leg of the Empire route. Thus, allowing a stop of half a day in Egypt, India would be reached in 4½ to 5 days, giving a time saving of approximately ten days, or 66⅔% over existing means of transport. A similar saving would also be effected to Australia and other points of the East. Put in another form the opening of a service to India only would give a saving of fully 33⅓% over the fastest steamship times to Australia.

Beyond India on the Australian route the meteorological data at present available is so incomplete that I do not feel justified in expressing any opinion at the moment as to the degree of regularity that could be maintained, although from the general weather conditions which are known there is no doubt that this route could be flown.

I have considered the airship as a whole and discussed its performance on specific routes, but to give a true statement of the present technical position of the modern British airship it is necessary to deal very briefly with the individual parts separately.

Hull

As I have already stated, it is possible to build an airship of 2,500,000 cubic feet capacity without embodying any features that have not already been tried out and proved in this country or in Germany: this hull would have a life of at least five years. This estimate is based on the careful examination of previous airships, an examination which shows that after a life of three years there are no signs of any deterioration of the framework. It should also be realized that it is comparatively simple to build in new girders where any local deterioration is found, and it is only in the case of general deterioration that it would become necessary to delete the airship.

Fabric

In the past, British gas-bag fabric has given a certain amount of trouble. This fabric consisted of a cotton fabric base on which is stuck two layers of gold-beaters' skin to give the necessary gas-holding properties. The medium employed to attach the skins to the fabric is a matter of the utmost importance. The Germans have employed a gelatine glue, whilst a rubber solution has been used in this country. Also the actual method of laying the skins was different in the German case to that employed here.

In the course of extensive experiments which have been carried out in Egypt during the past year, it has been demonstrated that the thin film of rubber employed for adhesion suffers badly under tropical conditions and is in all respects unsuitable substance to employ on airships which will have to do much flying in tropical or semi-tropical regions. Samples of German fabric stuck with gelatine glue which were also tested in Egypt have however not suffered in this way, and, therefore, by employing the German method of gas-bag construction, there is little doubt that we can make gas-bags in this country which will give satisfactory results under all conditions.

Engines

The requirements of an airship engine are essentially different from those of an aeroplane engine, yet no British airship engine has been developed.

In commercial airships the average flight will be about 50 hours, the engine will be required to develop ¾ power, with occasional stops, for the full period, whereas an aeroplane engine is only required to run for about six hours. The modern airship starts its journey with about 20 lbs. of fuel for every rated horsepower of the engines, while the corresponding figure for aeroplanes does not exceed five. This indicates the relative importance of fuel economy and engine weight in the two cases.

An engine designed for airship work may, therefore, have a higher weight per H.P., provided there is a corresponding decrease in consumption, and such an engine running at lower revolution would be more reliable and have a longer life. The Germans by developing the Maybach engine for airships have produced an engine of this type and it has given most satisfactory results.

A probable development in the near future is the introduction of the heavy oil engine which would result in a considerable reduction in running cost.

Safety

The question of the safety or danger of a modern airship may be considered under two headings: (1) dangers due to fire and (2) dangers due to weather conditions. The dangers due to fire may be again sub-divided into those due to petrol fuel and those due to hydrogen.

As regards petrol, the danger from this source, contrary to popular opinion, more serious than the danger from hydrogen. But on the other hand the danger from petrol is no more serious than from the same cause in an aeroplane. It is obvious that every effort should be made to eliminate it, and the introduction of a heavy oil engine would almost entirely remove this danger. In the meantime, however, much can be done by the mechanical refinement of the fuel installation and the abolition of any contrary causes of fire such as sparks from electric leads, which will render this danger almost negligible.

Turning now to the possible dangers from hydrogen, it should be emphasized that the ignition of hydrogen has been, in all cases of fire in rigid airships, a secondary cause only. These cases have been few, except for those due to enemy action, a point to which I give further consideration at a later stage.

Weather Conditions

I think it is not generally realized that the airship is perfectly safe in the air as far as weather is concerned, and that

on the occasions when modern airships of proved type have been wrecked it ws invariably due to accidents happening whilst handling on the ground.

(a) *Electrical disturbances.* The chief danger in an electrical disturbance is not, as is generally thought, due to lightning, but to the very violent air currents that might bring excessive strains on the hull structure. It is, however, even with the present meteorological organization and with the present air knowledge, comparatively easy to avoid thunderstorms. I can definitely say that thunderstorms in this country do not constitute a danger to airships, neither will they constitute a danger in the tropics, as with the development of airship routes the meteorological organization will be extended to meet our comparatively simple requirements.

(b) *Snow.* The danger from snow is the possibility of the airship becoming so heavily coated that she will be driven to the ground. Experience gained in the air and from maintaining an airship at the mooring mast points to the fact that little danger exists from dry snow as this snow blows off and does not collect on the airship. Damp snow and sleet are the chief dangers. When flying through snow and sleet, however, at the first sign of snow collecting the airship can rise into the dry snow, 1,000 ft. in most cases being sufficient.

Mooring Mast

I do not intend to go into details of the Mooring Mast, but I would like to state that the recent experiments, carried out at Pulham under the Controller-General of Civil Aviation, have proved beyond doubt that the Mooring Mast is a practical proposition.

The results of these experiments have proved and demonstrated:

(1) That an airship can remain at a mooring mast comfortably, in winds up to 60 m.p.h., riding through hail and snow squalls.
(2) That an airship can with ease leave a mast in a 40 m.p.h. wind.
(3) That an airship can land at a mast in winds up to 32 m.p.h.
(4) That necessary running repairs can be undertaken with safety on an airship at the mast.

From these results it is obvious that an airship can leave a mast or land to a mast in all ordinary weather so that there is no difficulty in an airship working to scheduled time.

Moreover, the danger of handling an airship on the ground is reduced to a minimum owing to the comparatively few occasions on which it will be necessary to put an airship into a shed, an operation which will only be carried out under selected weather conditions.

Before passing on from the technical position of the airship today, I would like to mention that in estimating the performance of the airship I have not taken into consideration any future developments which would improve this performance and which are now in sight, one of the more important of which is the utilization of waste hydrogen as fuel. Experiments in this direction which have been carried out and which have proved most satisfactory, indicate that a considerable economy in fuel may be expected, the direct result of which will be to increase the commercial load of the 2,500,000 cubic feet airship mentioned before by something in the order of 40 per cent over a 2,000 to 2,500 mile journey.

It may interest you to know that the present technical position as outlined would be considered by the Germans as pessimistic. I am also in a position to say that they would be prepared to build a ship with a higher performance than I have proposed and to guarantee this ship to stand all necessary tests.

The Value of Airships for Defense

I would like to give here my views on the bearing which the economical development of airships has on their uses for service and defense purposes. It is my firm conviction that the airship can play a most important part in the defense of the Empire, and the establishment of commercial services will give us in time bases and mooring masts at essential points throughout the Empire. I therefore suggest that when considering the commercial development of the airship we should not overlook the value of these bases for airship co-operation in naval defense.

It is perhaps unnecessary to emphasize the point that we must not think only in terms of the North Sea. During the recent war the airship was largely immobile, but with the successful development of the mooring mast this is no longer so. Given the existence of mooring masts and fuelling points the airship is today the most mobile form of transport, over large areas, in the world. Thus concentration at any point or in any particular area would be secured at a maximum of speed and with a minimum of delay.

The advantage of this will be obvious when concentration is required for general naval operations, for dealing speedily with the operations of raiders, which to us will always be of serious moment and, more important still, for patrolling the main trade routes of the Empire and for convoying purposes in any part of the world. When you recall, as one example, that India, by airship, will be less than five days distant these points gain emphasis.

In these circumstances I therefore say that with the establishment of Imperial Airship Service a new era will arise from the defense point of view.

I cannot omit the question of vulnerability:—There is no doubt as things are at present that the airship is very vulnerable from the military point of view, largely owing to the use of hydrogen, but the question of the protection of the airship against incendiary attack has not been fully worked out although experiments with helium and in the use of an outer envelope of non-inflammable gas, have given very promising results. These experiments will undoubtedly go on, if not here, certainly in other countries, until satisfactory results will, I believe, be actually obtained.

Successful developments along these lines would eliminate the disadvantage under which the airship has worked in the past and works at present where heavier-than-aircraft can attack. But this limitation applies only as I see it where an airship is operating over waters controlled by the enemy or in close proximity to hostile land bases. Over the large sea areas and along the main trade routes an entirely different situation arises. There, to be effective, attack by enemy heavier-than-aircraft will necessitate the use of aircraft-carriers. To my mind this necessity, even under present conditions, removes very greatly the handicap of vulnerability as it will be apparent that if the enemy do not control the waters, aircraft-carriers will not be able to operate with any hope of success. This is most important and is my reason for asking you to consider the commercial and the defense possibilities of the airship together.

In addition, little has been done to equip the airship with the most satisfactory form of armament either for attack or defense. I believe, personally, that the airship would provide a good gun-platform and, with heavier armament and greater accuracy of fire than the attacking aeroplane would possess, it should give a good account of itself. The possibility of acting also as an aircraft-carrying ship, both for purposes of attack and defense, should not be ruled out.

I have put forward these views because I consider them of very great importance in reviewing the airship position. To sum up on this particular aspect, the real reason, in my opinion, why the airship is not employed extensively at the present time for naval purposes is not attributable to the lack of naval work on which the airship can be successfully employed, despite her apparent vulnerability, but entirely to the absence of mooring masts and bases in the various parts of the Empire.

The establishment of the necessary ground organization in the Dominions and India is, therefore, of primary importance not only to improve Imperial communications and to develop commercial possibilities, but in no less degree to utilize the airship to the utmost for Imperial defense. The erection of these bases for an Imperial airship service, to repeat the point in another way, would immediately make the airship of considerable value for Service purposes and conversely the establishment of bases for Service airships would also be of great assistance in furthering commercial airship projects.

Conclusion

In conclusion I would like to summarize my main points as follows:—

Firstly, technically the airship is today in a position, without waiting for further improvements, to be usefully employed for both commercial and defense purposes.

Secondly (given the establishment of certain bases and mooring mast equipment, the airship of today is the most promising means of solving the vital problem of speeding up Imperial communications. The information which I have laid before you proves conclusively in my opinion that the route to India could be successfully opened up immediately the bases are established.

Thirdly, with the establishment of certain bases and mooring masts the present-day airship will become through its greatly increased mobility a vital factor in national defense.

These points alone in my opinion necessitate the most thorough investigation of all possible means of solving the financial problem which is the only bar to the immediate initiation of an Imperial airship service.

There is, however, another point for consideration. Will any financial economy be effected by the temporary cessation of airship activity in this country? In my opinion it will not, as the position in foreign countries, will, as I see it, within two years make a reconsideration of the airship question essential and at a cost considerably in excess of anything which would be necessary today.

This is an additional and weighty argument in my opinion for making every endeavor to find now a solution to the financial problem.

I would again like to emphasize that the first stages of the Imperial air routes to be established are:—England-Egypt; Egypt-India and then India-Australia. The establishment of the England-Indian route only, with its immediate benefit to Australia, would be a solution of a large part of the Imperial communications problem. If, therefore, the Dominions find it impossible to provide the whole of the money for the establishment of the complete scheme, it is urged that the England-Indian route should be concentrated on. The amount of money required for this route would be considerably less than that required for the complete scheme.

It is suggested that if, taking into consideration the value of establishing this route from both an Imperial and Defense point of view, the parts of the Empire concerned could even do no more than finance the provision of the ground organization, would not commercial interests recognizing the possibilities be prepared to do their part? This seems to me to be a possible solution.

I have suggested the importance of airship work from the point of view of Imperial communications and Defense; the commercial possibilities in reducing the time of transit to India from 15 days to 4 or 5 days, and of bringing Australia within 10-12 days instead of 35 days, speak for themselves.

Finally, I would like to say that I do not want any one to think I am making an appeal for the preservation of the present British airships just because they are airships, but because, as I have tried to tell you, it is my opinion that airships can do work today, if bases are established, which is of great importance to the Empire.

DETERIORATION OF AEROPLANE FABRICS*

By FR. WENDT

32nd Report of the German Experimental Institute for Aviation at Berlin-Adlershof.

THE observation that aeroplane fabrics, after long use, lose their original strength, caused the German Experimental Institute for Aviation to carry out a series of experiments on the effect of weathering on the cloth covering of aeroplane wings and fuselages.

An air traffic company furnished, for this purpose, "doped" and painted fabric which had been used on the wings and fuselage of a military aeroplane converted into a traffic aeroplane. It may be assumed that the wing fabric originally conformed to the specifications of the "Flugzeugmeisterei" (technical aeroplane section). At that time, the stipulations for undoped fabric, when the warp was parallel to the ribs, required a tensile strength of at least 700 kg/m in the direction of the warp and of at least 1000 kg/m in the direction of the woof; also that the elongation should not exceed 12% in the direction of the warp, nor 70% in the direction of the woof. Doping increased the tensile strength about 50%, or to about 1050 and 1500 kg/m respectively.

The tensile tests were made with a fabric-testing machine constructed by the Schopper Company in Leipzig. Both tensile strength and elongation were determined. The free length of the tested strips was 20 cm. Since it was impossible, in these strips, to distinguish the direction of the warp from that of the woof, no test could be made in this respect. The results of the tests are shown in the tables.

Sample I: Old doped aeroplane fabric from the bottom of a left upper wing with gray and black paint already beginning to scale off.

No. of Test	% Elongation	Tensile Strength in kg/m
1	3.6	1200
2	4.8	1160
3	4.0	1173
4	3.6	880
5	4.0	1033
verage.....	4.0	1089

Sample II: Old doped aeroplane fabric from the top of a left upper wing, with gray paint already scaling badly.

No. of Test	% Elongation	Tensile Strength in kg/m
1	4.7	550
2	4.0	444
3	4.4	486
4	4.2	486
5	4.0	533
Average.....	4.0	499.8

Sample III: Old doped aeroplane fabric from the fuselage, with green paint beginning to scale.

Series (a)

No. of Test	% Elongation	Tensile Strength in kg/m
1	3.6	1000
2	4.2	1050
3	8.0	1112
4	6.7	764
5	7.3	913
Average.....	5.96	947.8

Series (b)

No. of Test	% Elongation	Tensile Strength in kg/m
1	9.8	803
2	8.7	954
3	4.0	996
4	8.8	767
5	3.2	1164
Average.....	6.9	936.8

While, as shown by Table I, the fabric from the bottom of the upper wing still had a tensile strength of 1089 kg/m, the sample from the top of the upper wing, which was most exposed to the weather, had a tensile strength of only 499.8 kg/m. which must be considered much too small for a doped fabric. The tensile strengths of the fuselage covering (Tables a and b) varied between 937 and 948 kg/m. It is not impossible that the fuselage covering may have been of poorer quality than the wing covering, as it only had to afford protection against wind and weather and was not subjected to great stresses.

The tensile strengths stipulated by the "Flugzeugmeisterei" were fully great enough. Pröll demonstrated in his experiments, instituted by the "Flugzeugmeisterei," that tensile strengths of 700 to 800 kg/m. in the weaker direction was fully sufficient for undoped wing fabrics.*

As already mentioned, the samples tested were covered with a coat of paint. This served to advertise the air traffic enterprise and to awaken an interest on the part of the passengers. Unfortunately, however, when not employed with the necessary technical knowledge and caution, the paint may constitute a great source of danger, for it is a simple and sure means of quickly and easily concealing many defects of the wings, like tears, peeling patches and badly weathered spots and sometimes so as to deceive even the experienced eye. Herein lie great dangers and disadvantages for the aeroplane, and eventually for air traffic.

It cannot be regarded as a means of strengthening old doped fabric, although it seems to have sometimes had that effect, as the paint does not combine with the dope. There is rather in flight a reaction of the two substances against each other, which causes the paint to scale, especially on top of the wings. Weathering influences, such as moisture, heat variations and wind, vortex motions of the propeller stream and the lift-generating suction gradually destroy the fabric.

Fatigue phenomena**, which appear especially after great stresses during flight, and are indicated by slackness of the doped fabric covering, likewise cause gradual deterioration. Pröll demonstrated experimentally† that the fabric, when freed from the load to which it had been subjected for a long time, was at first slack and almost devoid of elasticity. This condition was however of short duration. The fabric recovered its previous elasticity to a certain extent, indicating a good quality of dope.

A good paint should supplement the dope to a certain degree and reduce the moistening of the fabric to a minimum. The German Experimental Institute for Aviation is about to undertake further experiments on the availability and behavior of paint as a strengthening coat and will report later.

* From "Zeitschrift für Flugtechnik und Motorluftschiffahrt," November 30, 1921, p. 325.

* Technische Berichte der Flugzeugmeisterei, Vol. III, p. 282, published by R. C. Schmidt, Berlin.

** Compare C. G. Gray in the *Aeroplane* of October 5, 1921, No. 14, pp. 293-296, and p. 307.

† "Zeitschrift für Flugtechnik und Motorlufschiffahrt," January 31, 1920, P. 20.

NAVAL and MILITARY AERONAUTICS

Large Armored Attack Triplane Assigned to 90th Squadron

The large, armored attack triplane which has excited so much interest and comment among the members of the 3rd Group (Attack) at Kelly Field, has been assigned to the 90th Squadron. This ship, a design of the Engineering Division at McCook Field and built by the Boeing Aeroplane Company of Seattle, Washington, is the first of several of these planes to be delivered for the use of the Attack Group. It is especially designed and constructed for the attacking of ground troops. In addition to being armed with machine guns, it carries a small cannon.

The power plant consists of two Liberty 12's set in a steel compartment, located in each wing. All vital parts are similarly protected with armor. The weight of the ship empty (including water) is 7,532 lbs., and with crew, armament, and gas and oil, 9,750 lbs. The weight per horsepower is 11.2, absolute ceiling 11,500 and service ceiling 9,600 feet. The rate of climb is 600 feet per minute. It takes a run of 285 yards before it leaves the ground and rolls 326 yards in landing. The overall span is 65 feet, 6 inches; overall length, 33 feet, 7 inches; overall height, 14 feet, 3 inches. The minimum speed at sea level is 63.6 miles per hour, and the maximum speed 105 miles per hour.

Aeroplane Drill at Bolling Field

The first of a series of monthly aeroplane drills was held at Bolling Field on Friday, January 20th, the occasion being the monthly inspection of the station by General Bandholtz, Commanding the District of Washington.

The program called for an hour's exhibition and was run off promptly, efficiently, and without a hitch. First on the program was a combat between Lieut. Wolfe in an SE5, who attacked Lieut. Maitland in a Fokker, the latter having just "opened up" on a Martin Bomber which was on its way to Philadelphia; then a radio exhibition by Lieut. Beaton, who read the morning news from his plane through a Magnavox and was told "how and when" to maneuver his ship by voice from the ground. Then came Lieuts. Smith, Boyd and Van Veghten up the Potomac River in a beautiful formation of DH's on a bombing raid over a temporary village erected at the south end of the field. The alarm siren blew, the bombs dropped and the buildings collapsed. Two of them burst into flames. Three SE's took off in a hurry and chased the formation off, separated Lieut. Boyd from the others and drove him to earth. In the meantime, Lieut. Ramey had taken pictures of the fires and the field, including the spectators. They were developed and distributed before the people went home.

Indiana National Guard Squadron Is Forging Ahead

The 137th Observation Squadron, Air Service, Indiana National Guard, located at Kokomo, Indiana, has received two new government steel hangars, and a contract to erect them complete, with concrete floors, has been let by the State, erection work to start at once.

This squadron is the first Air Service unit to be Federally recognized in the Fifth Corps Area, and one of the first in the United States. The unit occupies the 100 acre flying field, owned and operated by the Curtiss-Indiana Company, which has one of the largest and best equipped flying fields in this country, being credited with 50,000 miles of flying with their 27 ships in the past year.

The squadron is under the command of Major Wilber M. Fagley, and the officers are nearly all ex-army fliers. The enlisted personnel is composed of men picked from the automobile plants and other factories in Kokomo, and they are particularly well fitted for the various technical duties in connection with an organization of this type. The interest shown in this unit is evident from the fact that the total strength has increased 43% during the last month, bringing the enlisted strength up to 127.

Camp Nichols, P. I., Now An Air Service Station

The clearing house for Philippine Scout recruits for years—Camp Nichols, P. I.—has been converted into an Air Service station. The old post has been awakened from its peaceful slumber of contentment, the Air Service troops are policing up the old post, and the interest they take in it is admirable. The Quartermaster Corps is employing a gang of natives to clear so much of the camp that is to be converted into a flying field. Large trees and innumerable clumps of bamboo are being uprooted by means of a steam roller. Filling and grading are being done by means of plows and harrows. When the new field is completed it will be as level as a billiard table, and will be approachable from all directions. Camp Nichols is located in the suburbs of Manila, and is considered an ideal station.

The field is of an "L" shape, the foot of the "L" being slightly over 500 yards in length and the leg of the "L" something over 650 yards in length. The construction of the field for the $5,000 which has just been authorized by the War Department will tend to make it one of the most inexpensive fields ever provided for the Air Service. By having this field and also the $10,000 field to be constructed on Corregidor, all heavier-than-air craft will then be able to fly between, and land at, all stations. The flying field on Corregidor will be not be a school aerodrome, but one from which service flying can be very readily carried on.

New Stabilizer to be Tested

One of the JN4D training planes at Mather Field, Mills, Calif., was turned over to the Aerial Mail Service on January 12th for the purpose of making experimental flights to test the Converse Stabilizer, a small device which its inventor, who has been working on it for many months, claims will hold the ship longitudinally balanced, regardless of conditions. That part of the stabilizer controlling the ship latitudinally has not been perfected.

New Colors for the Air Service

Specifications for the Army uniform, recently issued by the War Department, give as the Air Service colors ultra-marine blue piped with golden orange.

Flies to Scott Field to Receive French Decoration

Troops at Scott Field, Belleville, Ill., were lined up in dress parade in front of headquarters on the occasion of the presentation of the French Medaille d'Honneur to Adam J. Wesley, a farmer residing near Virden, Ill., who was formerly a private in Company A of the 42d Engineers. Having received notification from the War Department that the French Republic had conferred the medal on Wesley, Major Frank M. Kennedy, Commanding Officer of Scott Field, notified Wesley of the honor that awaited him and that he would be taken to the field and back to his home in an aeroplane. The ex-soldier made the air journey to the field in 35 minutes, Lieut. Wells piloting the plane. In the afternoon, after the medal was pinned on the breast of the recipient by a member of the French Consulate at St. Louis, the soldiers of the field marched in review before him, after which he was taken home via aeroplane again.

New Armory and Hangars Built in Kokomo

The State of Indiana has leased a new Armory in Kokomo, to be used jointly by the 137th Observation Squadron Air Service and Battery A of the 181st Field Artillery.

The building is being erected and financed by Mr. D. C. Spraker, a local citizen, on a tract of ground owned by him. The plans and specifications were approved by the Adjutant General of Indiana, and the building when completed, which must be within 120 days, will be leased by the State for a period of 10 years. It is to contain offices and orderly rooms for each organization, large drill floor, locker rooms, showers, kitchen and dance hall and garage for the storage of all the Battery's material and parts of the Observation Squadron's road equipment. All of the Squadron's flying equipment is kept at the field, 2 miles south of the city. The road equipment is kept in town to afford transportation for the men to and from the field.

The construction of the Armory and the two new hangars at the field has awakened much interest in the Unit and many new names have been added to the roster. Much credit is due the Kokomo Chamber of Commerce and the citizens, through whose cooperation it has been possible to maintain two National Guard Units in a city of this size.

Kokomo is a city of 35,000 population, 50 miles north of Indianapolis, and is probably best known as the home of Haynes and Apperson automobiles. The field is well marked, easily approached, convenient to town, and a welcome is extended to all visiting pilots. Gas, oil and service is available at all times.

FOREIGN NEWS

Manufacture of Aeroplanes in Japan

The Mitsubishi Motor Co., at Nagoya, has made progress in the work of manufacturing its new type of aeroplane, and will soon be turning out complete machines. The company's application for permission to establish an aviation field in front of its works at the port has received official sanction.

A trial flight with an experimental aeroplane completed by these works, in which a 300-horsepower Hispano-Suiza motor was installed, showed satisfactory results. The aeroplane was constructed after the plan of a British engineer; while the details of construction are kept secret, it is said to be a high-speed fighting plane, to be known as the Mitsubishi type. The company plans to undertake construction of this type of biplane.

Work has been started by the Aichi Tokei Denki Kabushiki Kaisha (Aichi Clock & Electric Machinery Co., Ltd.) on the construction of a factory in the neighborhood of Nagoya to which the works of the company now at Atsuta, will be moved. It is expected that the factory will be completed by the end of 1922. The present works are capable of turning out one aeroplane a month, of the Yokosho type; the new factory will have a capacity of 50 planes a month. Besides the manufacture of airplanes for military purposes, special attention will be given to the production of large commercial planes.

The Kawasaki Works of Kobe are contemplating the erection of aeroplane factories in the Gifu Prefecture. Construction was scheduled to be started in November, 1921, and to be completed in the spring of 1922, when 500 workmen will be detached from Kobe to engage in the manufacture of aeroplanes.

French Aeronautics

The French Air Budget for 1922, as passed by Parliament, totals approximately 436 million francs. The main appropriations are: Minister of War: For Home Squadrons, 214,287,500 francs; Algeria and Tunis 9,936,490 francs; Morocco, 22,173,092 francs; total 246,-397,082 francs. Under Secretary of State Department for Aeronautics; 147,219,970 francs, which includes foreign air attaches, 200,000 francs; technical service, 5,400,000 francs; prizes and subsidies for commercial aviation, 45,382,000 francs. Ministry of Marine, 37,318,-543 francs; Ministry of Colonies, 4,991,000 francs.

Of considerable interest and importance are the figures now available for the past year's growth of flights and passengers and freight carried. For the full 12 months to December 31, 1921, compared with 1920, the figures are: 1921—Flights, 4,022; passengers 13,369; goods, 150,309 kilogs.; mails, 3,308. 1920—Flights, 3,359; passengers 6,850; goods, 120,745 kilogs.; mails, 1,474. For the month of December the figures are: 148 flights (arrivals and departures), 359 passengers, 7,277 kilogs. of freight, and 84 kilogs. of mails. These figures are for the airways in operation between Paris and London; Paris, Brussels and Amsterdam; Paris, Strasbourg, Prague and Warsaw; Paris and Amsterdam; and Paris to Havre.

The Berlin-Augsburg Route

Over the Berlin-Augsburg air route, which the Rumpler Co. have been exploiting, the totals for 1921 are given as 1,244 passengers and 3,286 kilogs. of mail carried.

From Berlin it is reported that the Moscow Soviet has approved a draft agreement with a German air line company for a regular service of postal and passenger aeroplanes between Moscow and Berlin, via Kovno and Konigsberg. It is added that the Lithuanian and Lettish Governments have given their assent to the scheme.

The Ambulance Aeroplane

It appears that the ambulance aeroplanes of the Levant and in Morocco are growing rapidly in their emulation of each other, which is both admirable and profitable. Every day a new record is made by one or the other.

A few weeks ago in Morocco they made a remarkable record by transporting 18 wounded men 80 kilometers; now we hear that in the Levant they have just evacuated 44 wounded a distance of 400 kilometers over the desert of Syria between Deir-ez-Zor, on the Euphrates at the southern border of our mandate, and Aleppo. This last operation is record for transporting wounded by aeroplane. Moreover, the conditions under which it was done and the advantages gained merit attention.

After the victorious battles of the 24th and 26th of October, fought in the region of Deir-ez-Zor by Colonel Debieuvre against the warlike tribe of Ogueidats, who fought all the more fiercely against our troops because they had given a severe setback to the British in 1920, General Gouraud, High Commissioner in Syria, gave orders on October 26th to Medical Inspector Emily, Chief Surgeon of the Army of the Levant, and to Major Denain, commanding the Air Service, to prepare for the evacuation as rapidly as possible to Aleppo of the wounded we had during the course of these glorious combats. This work was rendered particularly difficult and dangerous due to the fact that the 400 kilometers which separate these two places is an inhospitable desert, without landing places, occupied by hostile Bedouin tribes, with atmospheric conditions impossible to have a gas station at Deir-ez-Zor, which is 20 days from Aleppo by camel convoy.

A detachment, composed of all the ambulance aeroplanes in service with the Army of the Levant, was immediately organized at Aleppo under the command of Lieutenant-Pilot Vindreau and of the Chief Surgeon of the Air Service in the Levant, Dr. Liegeois. On October 25th a military surgeon, Dr. Chevalier, went to Deir by aeroplane to render the urgent surgical assistance needed. The same day five aeroplanes brought back 10 wounded, covering in a few hours the 800 kilometers for the round trip from Aleppo to Deir-ez-Zor and return, a very remarkable performance when the difficulties enumerated above are considered.

Evacuation continued the following days, and soon all the transportable wounded—44 in all—were transported by air to the military hospital in Aleppo, making in three hours and a half and under very satisfactory conditions, as far as comfort was concerned, a trip which requires at least a week by motor ambulance, and by camel or cacolet (form of saddle for horse or mule, carrying two men in a sitting position) more than three weeks over heavy roads. This would have been very trying on the wounded men.

Thanks to the aeroplane, Principal Surgeon Chartres, Division Surgeon of the 2nd Division, was able to go to Deir to superintend the evacuation and care of the wounded. Dr. Liegeois, who followed and directed the operations from the medical standpoint, estimates that, without counting the suffering that was avoided, five wounded men owe their lives to this method of evacuation.

The results are a great honor to the Air Service of the Army of the Levant and especially to the pilots who, not satisfied with being courageous war pilots, have on this occasion given proof of their skill, endurance and training by bringing safely into port all the wounded confided to them, in spite of the difficulties of such a long flight.

It should be noted that in all the time that this means has been used for evacuation in the Levant, not a single wounded or sick man has been the victim of an aeroplane accident.

(*Translated by Lieut.-Col. F. P. Lahm.*)

Newest "Bristol" Engine Meets Official Test

The lightest proved engine of its power in existence, the "Bristol", Jupiter style, is the latest achievement of the Bristol Aeroplane Company, England, and marks an epoch in the development of the air-cooled radial aero engines. Weighing 729 lbs., the engine can be lifted by four men. It has 25% less parts than any other engine of equal power, and can be more easily and quickly dismantled and erected. The big nine cylinders develop 450 h.p. when working at 1840 revolutions per minute, the engine being cooled by the rush of air around the revolving cylinders. This method has the advantage not only of saving the weight and space of water for cooling, but also of economizing space, the whole engine occupying only two feet from front to back.

The report of the British Air Ministry on the test of this engine states that only two makes of engine, and these both water-cooled, have previously satisfied the rigid conditions laid down for the test, and the results achieved with the "Bristol" Jupiter engine are the more meritorious when one considers that it is lighter per horsepower than either of the two makes of engine which have previously received the final test certificate.

At the conclusion of the tests the engine was dismantled for examination. Very little signs of wear were visible, and the general condition of the engine was found to be excellent. Among other points which are of much importance may be mentioned that owing to the design of the induction system the engine starts particularly easily, and owing to the air-cooling it is especially suitable for starting up in very cold climates. By these tests the "Bristol" Jupiter engine has not only proved itself the most efficient engine of this type ever constructed, but also superior in reliability and all-round efficiency to the great majority of the heavier engines of water-cooled type.

A new fighting machine, expected to exceed in speed and maneuvering power anything attempted hitherto, also a British commercial aeroplane having a unique capacity for making loads pay, are to be built to take the new engine. It is a discovery of the first importance in the development of British air power.

Aerial Service for Queensland

Many of the railways of Queensland lead to "dead ends," which are but imperfectly linked-up, if at all, by road traction. But that, according to the *North Queensland Register*, will soon be altered by the Queensland and Northern Territory Aerial Service, Ltd. The ultimate idea is to establish an aerial service from either Bourke or Mungindi, in New South Wales, to Darwin, in the Northern Territory, linking up with the heads of the Queensland railways at Charleville, Blackhall, Longreach, Winton and Cloncurry; but the immediate object is to get the company floated so as to tender for an aerial mail from Charleville to Cloncurry, which is to be subsidised by the Commonwealth Government. The subsidy will pay for the running cost of the service, provision having to be made for carrying 100 lb. of mail matter. On this Charleville-Cloncurry service, representing a distance of 570 miles, the estimated revenue from subsidy and passngers' fares is £20,700 a year, while the expenditure, including depreciation, is estimated at £12,175, leaving a balance of profit of £8,500.

The International Air Traffic Association

At various times paragraphs have appeared in the press referring to the operations, either intended or active, of an organization called The International Air-Traffic Association, Ltd. Very little is known about this association and therefore it seems well to record the constitution of the association.

At present the membership is as follows:

Danske Luftfartselskab, Amaliegade 27b, Copenhagen, Denmark.

Finska Lufttrafik Aktiebolaget, L3 Skillnaden, Helsingsfors, Finland.

Danziger Luftreederei, 9 Elisabethwall, Danzig, Germany.

Svenska Lufttrafik Aktiebolaget, 7 Kungsgaten, Stockholm, Sweden.

Deutsche Luftreederie, 4 Sommerstrasse, Berlin, Germany.

Koninkliike Nederlandsche Luchvaartmaatschappij, 13 Heerengracht. The Hague, Holland.

All the above companies were represented at a meeting held at Stockholm recently.

The association was founded on August 26th, 1919. Its objects are the establishment of unity in the exploitation of air lines in which the territories of two or more States are concerned. The independence of the members is absolutely respected. In the beginning of February, 1922, a meeting of the Association will be held at The Hague and probably other companies will join the association.

Aviation in Norway

The American Consul at Christiana, Mr. Alban G. Snyder, reports that the Naval Hydro-Aeroplane Factory has recently tried out a new type of monoplane which was begun in March and carries a motor of 225 horsepower. Three other machines of the same type are expected to be finished at the rate of one a month. Monoplane "F52," as it is called, is entirely Norwegian built, carries four passengers, and is adapted for civil as well as for naval flying. It attained a speed of 160 kilometers per hour and rose to an altitude of 1,000 metres within 7 minutes. The same factory has built an aeroplane to run on skis, which is said to have been very successful.

The army is priding itself on the production of a new type of aeroplane, "F.F.9," which was successfully tested and attained the considerable speed of 135 to 138 kilometers per hour; previous machines have not exceeded 115 kilometers per hour. The landing speed of this new machine, which is the first of a series to 10 and is built by the Army Aero-Factory, is 85 kilometers per hour. Some of the other machines of this series will be fitted with "thick profile" wings.



Government Pamphlet Gives Data on Aerofoils

Report No. 124, "Aerodynamic Characteristics of Aerofoils—II" (continuation of report No. 93 which listed sections 1 to 214), published by the National Advisory Committee for Aeronautics, gives a number of wing curves suitable for experimental soaring planes. The following American and foreign curves are contained in this report:

American

U. S. A. 22, and 25 to 34 inclusive; Glenn Martin 1 to 6; A. E. G. 1 and 2; M-80 (Loening); Springer 2 and 3. A total of 22 aerofoils.

British

Fage & Collins 1 to 6; Bristol "Badger" and "Braemar"; Powell (Plain); Searle & Peatfield 1 to 4. A total of 13 aerofoils.

French

Eiffel 63 to 66; AR; Bleriot; Coanda 1 to 3; Juvigny; Kauffmann 111; Odier 110; Turin 3 and 4. Total number, 14.

Italian

Italian 307.

German

Göttingen 79, 147, 164, 165, 173 to 176, 184, 217, 222 to 229, 234, 239, 241 to 244, 255, 256, 265, 281, 284, 285, 288 to 290, 298, 300, 301, 303, 304, 319 to 325, 329 to 332, 335, 336, 344, 346, 358, 360, 363 to 367, 381 to 390, 393 to 395, 398, 400, 404 to 407, 409 to 416, 418, 420 to 426, 429 to 436, 440, 441, 446 to 450, 459 and 460. Total number of aerofoils, 111.

The above German curves include those known under the following names: Pfalz 11, M. V. A., Albatros, Flz. Junkers, Flz. Friedrichshafen, Flz. Fokker, Flz. Staaken, D. F. W., Hansa-Brandenburg and Daimler.

This collection of data on aerofoils has been made from the published reports of a number of the leading aerodynamic laboratories of this country and Europe. The information which was originally expressed according to the different customs of the several Laboratories is in this pamphlet presented in a uniform series of charts and tables suitable for the use of designing engineers and for purposes of general reference.

Each aerofoil section is given a reference number and the test data are presented in the form of curves from which the coefficients can be read with sufficient accuracy for design purposes. The dimensions of the profile of each section are given at various stations along the chord in per cent of the chord, using as datum the line shown on the curves. The shape of the section is also shown in reasonable accuracy to enable one to more clearly visualize the section under consideration, together with its characteristics.

Copies of Aerodynamic Characteristics of Aerofoils may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at ten cents per copy.

Activities in the World of Soaring Flight

Some members of the Aero Club of Ithaca, Ithaca, N. Y., have designed and are building a soaring plane, which is expected to be finished in the spring.

Warren H. De Lancey, corresponding secretary of the Illinois Model Aero Club, 430 South Michigan Avenue, Chicago, has reported a lot of interest in soaring flight in his locality and is interested in arranging a competition of soaring planes, in which his Club would have at least one entry.

Several members of the Long Island Flight Association, the first club organized in the United States primarily for soaring flight activities, are engaged in design and research work, the results of which the Club members have arranged to make public, for the benefit of those interested, through the medium of Aerial Age.

A monoplane glider has been designed by Mr. Carl H. Fastje, 323 West Railroad Avenue, Dennison, Iowa. It is to be constructed during the spring or summer. The wings are to be braced like the Loening or Thomas-Morse MB-7 monoplane. The body will have one upper longeron and two lower longerons. A rudder will be controlled by the pilot, but elevation will be controlled by shifting the weight of the body.

The Aero Science Club of Amecira designed and constructed under the supervision of Wm. J. Beach, a monoplane glider (not a soaring plane) which was illustrated in the Rotogravure Picture Section of the New York *Times* on February 5th. More details of it are expected to be published shortly.

Mr. J. H. Ruben, Portland, Oregon, has built an experimental soaring monoplane having a resemblance to Klemperer's machine. The wing is like the Alula wing of the Handalula monoplane.

Certificates Issued to German Soaring Pilots

The Union of German Model and Gliding Flight Association now issues certificates to the pilots of soaring planes. The first such certificate was granted to Klemperer, the pilot of the Aachen soaring monoplane. Up to the first of October, 1921, a total number of eighteen soaring pilots' certificates had been issued.

15 seconds' duration to the total of 1,300 feet, or of 40 seconds' duration must be made by the candidate.

Pilots desiring one of these certificates are required to give evidence of their ability to soar a distance of 1,000 feet, or 30 seconds' duration, or else flights of not less than 500 feet of

The systematic manner in which regulations of this kind are handled in Germany is one more evidence of the importance with which it is regarded, and does much to promote the general interest and progress in motorless flight.

The Aachen Soaring Monoplane

(*Concluded from page* 525)

The tail surfaces are constructed of wood veneer similar to the wing construction. The tail skid is made up of a number of cane sticks lashed with twine. The elevating plane weighs 3.1 lbs. and the rudder weighs 1.32 lbs.

All bolts are of aluminum. The control wires attached to the stick and rudder bar have, instead of turnbuckles, safety hooks which can be easily unfastened for dismantling.

The entire tail end weighing 24.2 lbs. can be taken off by two men in two minutes. For transport across country the wings as a unit can be placed laterally on a two wheeled cart.

In starting the machine for flight two rubber cords with hooks on the ends are attached to the rear ends of the skids. The rubber cords are then drawn taut while one man holds the tail end. On releasing the machine the man at the tail end lets go while the men in front start on a run. The machine leaves the ground very rapidly owing to the added impetus given by the stretched rubber cords. The machine with a weight of 136.5 lbs. and a pilot weighing 150 lbs. proved to be very stable, both in a wind of 9 miles an hour and a stiff fluctuating wind. The minute attention given to the proper balancing of the machine and the splendid performance of the thick section aerofoils make this type of machine most suitable for soaring flight.



An actual photograph of the Aachen Soaring Monoplane in flight



Some Comparisons of Bird and Aeroplane Structures

One of the things impressing those examining the bones of a bird is their unusual lightness. If we break one of them the reason for their light weight is apparent: the marrow that fills the bones of mammals is not present, the bones are hollow and their walls are thin. This is a great weight-saver. The bones are connected by air-sacs with the lungs and are filled with air. These air-sacs fill every available space within the body of a bird that is not occupied by some organ and when they are all filled with air, the bird becomes much lighter for its size.

Above all else, an aeroplane must be light. The materials used must be as light as compatable with strength and there must be no unnecessary materials or parts. So, in a bird, we find those structures called feathers, which are delicate, yet the strongest structures for their weight.

An aeroplane must also be compact, the heavier parts located close to the center of gravity. There must be no great weight on the wings or tail, or it will not balance in flight. This is most strikingly accomplished in the bird. Birds do not have fat calves; most of the muscles are on the upper leg, close to the body, and, when necessary, they are prolonged to the tips of the toes as very light tendons, just as is done in the wings. The body itself is short and deep for the same reason of bringing the heavy internal organs as close to the center of gravity as possible.

Junior Aero Club to Be Organized

With the interest of the Aero Club of America and that of the Aeronautical Chamber of Commerce of America, a nation-wide junior club is to be formed in the very near future. The purpose of this club, to be known as the Junior Aero Club of America, will be to affiliate all existing model aero clubs, societies and individuals with a view of a closer co-operation between themselves and of forming other local clubs throughout the cities of the nation.

Mr. Wanzer requests the special attention of the following Model Clubs, active or inactive as some of them may be:

Nebraska M. A. C., Lincoln, Neb.; Little Rock M. A. C., Little Rock, Ark.; Buffalo Aero Science Club, Buffalo, N. Y.; Milwaukee M. A. C., Wilwaukee, Wis.; Illinois M. A. C., Chicago, Ill.; Aero Science Club of America, N. Y. City; Scout M. A. C., Indianapolis, Ind.; Concord M. A. C., Concord, Mass.; Broadway M. A. C., Baltimore, Md.; Aero Club of Lane Technical H. S., Chicago, Ill.; Pacific N. W. Model Aero Club, Seattle, Wash.; Bay Ridge M. A. C., Brooklyn, N. Y.; Aero Science Club of Indiana Univ., Bloomington, Ind.; Pacific M. A. C., San Francisco, Cal.; Constantine M. A. C., Constantine, Mich.; Pasadena Elem. Aeronautics Club, Pasadena, Cal.; Model Aero Club of Oxford, Pa.

Among other departments, at present planned to be established at headquarters, is a Bureau of Technology and Engineering, a service which shall be at the command of members for such purposes as research work, designing of aeroplanes and parts thereof, the working out of technical problems, etc., etc.

National competitions will be held and everything possible done towards the furtherance of aeronautics. The committee in charge of the organization is represented by Mr. G. Wanzer, Jr., 1902 Rosemont Road, Cleveland, Ohio, to whom all inquires on the subject should be directed.

Portland Model Aero Club Notes

The Portland (Oregon) Model Aero Club held its first contest of the year on February 4th, 1922. This contest was for "rising-off-ground" for distance. The winner was presented with a pennant with the club colors. Among the models of interest was a four-propeller tandem biplane entered by Mr. M. Walker, of the P. M. A. C.

Mr. Jack Clark is the President of the Club and Mr. Albert Roenicke is its Secretary-Treasurer.

Adjustable "Elevating Blocks" Devised

A new type of "elevating block," original with the Portland Model Aero Club have proven to be very convenient when it is necessary to shift the front elevating plane on pusher type models.

Usually a solid wood block is permanently bound to the frame, but its fixed position does not allow of adjustments fore and aft, often required when looping or other manoeuvres are to be made.

The principle of the new "block" is an inverted U with a flat top, made by bending 1/32 inch hard fibre, aluminum or cardboard. The pattern should measure about 7/8 inch square. Place the pattern over the frame member upon which it is to be used and bend down the edges at either side. This gives us the inverted U shape. Small holes should be made about



Racing type model entered in Portland Model Aero Club Contests by Jack Clark

1/8 inch from each lower corner, and (when the U has been lifted from the frame, of course) two pegs run from one side to the other. This raises the U to give an angle to the elevator plane. A deep notch should be cut through the top, parallel to the pegs, which holds a rubber elastic, binding it to the frame. Thus the pegs rest on the frame member, and the rubber allows it to be moved fore and aft as desired.

If cardboard is used, it should be shellacked to give it greater strength and stiffness. Besides being light, a little resistance is saved by the fact that the air can pass under the inverted U. A pair of such blocks are required on the conventional types of twin pusher models.

Little improvements such as this help to make better and more efficient models as well as leading model builders to take more thought and care in the development of minor details.

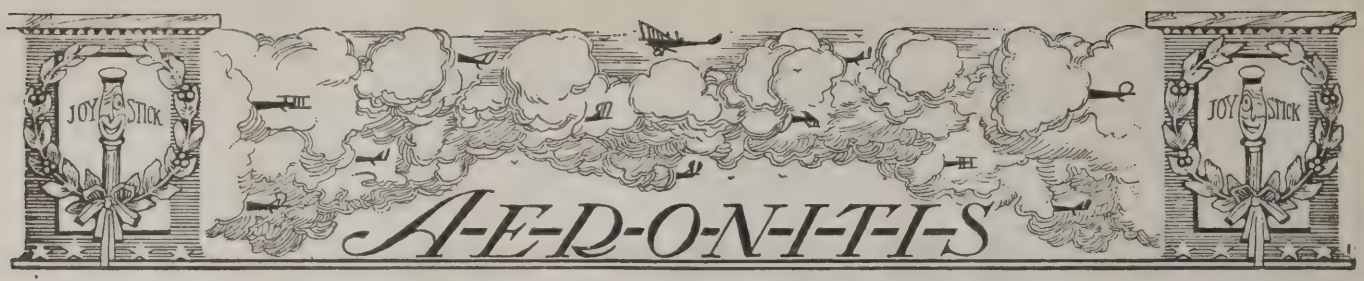
---

60 H.P. Anzani Engine on View

Inasmuch as the Anzani air-cooled engine is now receiving much publicity in connection with small sport planes, it may interest our readers to know that Mr. C. H. Wissler, Bellefontaine, Ohio, has in his possession the only 60-65 H. P. six-cylinder, 3-valve, air-cooled Anzani engine in the United States at the present time. He had this engine ordered from the factory in France since January 4th, 1921, and receiving it on September 12th, 1921. The engine actually arrived in this country on July 12th, but on account of an error on the part of the Express Co., it was held up in New York for sixty days.

Anyone wishing to see this engine can do so by calling on Mr. Wissler, who makes this offer, not as an agent for the Anzani engine, but for the benefit of anyone interested in aviation and because of the fact that this is the only engine of this model in this country. There are some smaller (45 H. P.) engines of this type in New York, but the 60 H.P. model has several different features not incorporated in the 45 H.P.

All valves are mechanically operated in this engine; a decided advantage over the old style automatic intake as is used on the older 40 H.P. and 90 H.P. types shipped to the U. S. Government during the war.



The H-Boat

Listen my friends while I tell you true
Of an awful ride in the H S 2.
I've flown in "Jennies" and the D H 4,
In the Martin, The Fokker and a good many more,
But of all the things that have got my goat
The worst was that ride in an old H-Boat.

Have you ever sailed—now tell me pal,
On an old flat barge on the Erie Canal?
They're both the same, you can believe,
On neither, the slightest thrill you'll receive.
After the Fokker it got my goat
To have to ride in that old H-Boat.

The D H I'll admit is far from the best,
But the H-Boat—really I can't say the rest;
We "taxied" her out a mile from shore,
And the "Take-off" took us a good mile more.
Really, no wonder it got my goat
To have to ride in that old H-Boat.

A "Jennie," my friends,—now there's a ship
That surely can dive and loop and dip;
Which same I claim makes up for the fact
That she's not speedy—but she sure can act.
And so I believe 'twill get your goat,
If you have to ride in an old H-Boat.

—*B. H. Krueger, Luke Field.*

The Dying Hobo

'Twas out by a western water tank
One cold November day
Where in an open box-car
The dying hobo lay.

His partner stood beside him
With a sadly drooping head
A-listening to the last words
The dying hobo said.

"Goodbye, pal, I'm going
To a land where all is bright,
Where the handouts grow on bushes
And you sleep out every night."

His head sank back;
As he sang his last refrain
His partner stole his shoes and socks
And grabbed an Eastbound train.

—*Whiz Bang.*

A wonderful bird is the pelican
Whose beak can hold more than his belican
But I don't see how in the helican.

—*R. D. Kimmell.*

VIOLA: It was a case of love at first sight when I met Anthony.
FLORENCE: Why didn't you marry him?
VIOLA: I met him again so often.

NED: Marjory is a beautiful bud.
ALF: Why do you call her a 'bud'? In polite society, old bean, a bud is a girl who has not yet blossomed into a wall flower.

The "Miss"

Well, I'll be hanged, will you look at this?
The dawgone boob calls his ship "The MISS."
Tell me, is the poor boob crazy,
Is his mental horizon a little hazy?

Wait a minute buddy; it's not that bad,
Really, the boy's not one bit mad.
You see he says, of all things he knows
She's most like a "Miss" when she ups-and-goes.

Women you know are most generally
The essence of contrarity;
And so he says 'tis with the "MISS,"
Her charm lays all in uncertainness.

Come along and he will tell you the same,
The reason he calls his ship that name:—
"I call her that, as my friend told you,
Cause like a woman, she's always new.

You never can tell just what she'll do,
And most of the time she leaves it up-to-you
To pull out of the trouble as best you can,
Just as a woman will leave a man.

But tho she's as fickle as she can be,
I tell you my friend, she is "The One" for me;
Of all the ships on the field, She's the best,
The "Miss" is better than all the rest.

B. H. Krueger, Luke Field.

The Effect of Environment

"Say, waiter, is this an incubator chicken? It tastes like it."

"I don't know, sir."

"It must be. Any chicken that had a mother could never get as tough as this one is."—*Wampus.*

"Willy! Here you are again making mud pies with this filthy dirt. Why don't you play with that art clay I bought you?"

"Aw, ma, have a heart! That stuff don't taste near as good as this!"—*Punch Bowl.*

As In a Glass Darkly

The absent minded professor surveyed himself in the hair-brush, instead of the mirror.

"Gracious, I need a shave!" he mused.—*Sun Dodger.*

A 25 Year Guarantee

Mr. and Mrs. Binks bought a cradle for their first child.

Some years later Mr. Binks was rocking their thirteenth in the same cradle. The cradle broke. Handing his spouse a fifty-dollar bill he said: "Here, Mary, go out and get a cradle that will last."—*Widow.*

The expert who used to tell us that the war would be over in six months has found a new job.

He is now predicting the return of the long skirt.—*Life.*

"I've got that dope down Pat," said Mrs. Murphy, as she laid down the bottle of castor oil.—*Harvard Magazine.*

UNIVERSITY OF ILLINOIS LIBRARY

1922

AERIAL AGE WEEKLY

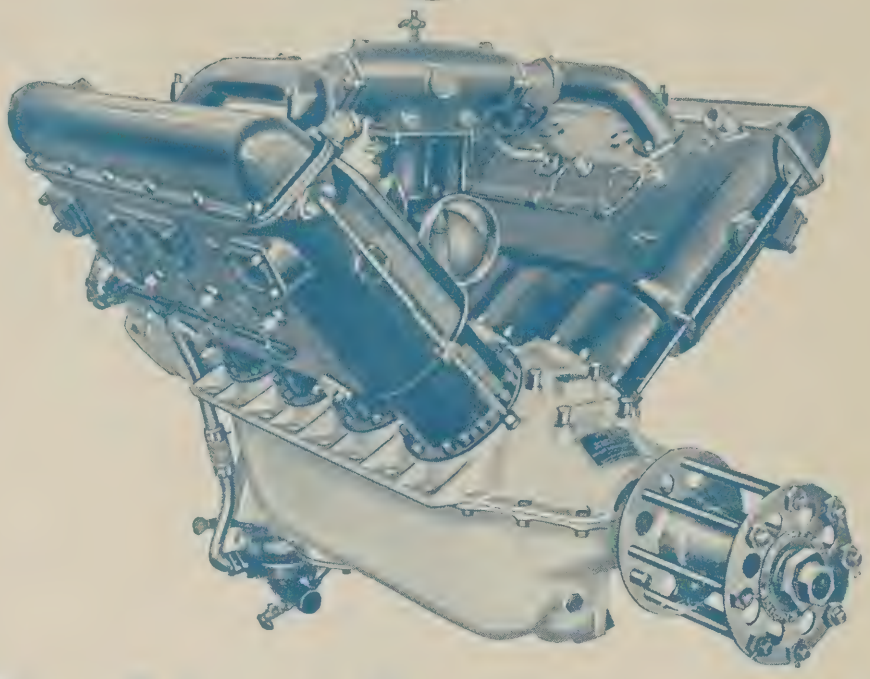
OL. 14, No. 26 MARCH 6, 1922 10 CENTS A COPY



"Glencoe House," Residence of Mr. Thomas McKean, Rosemont, Penna.
Photographed by Captain Suydam of New York

The Roma Disaster—Air Transport in America—Aerial Transport Today and Tomorrow

SHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
iptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1



The Vital Requirements of Pursuit Engines

COMPACTNESS

(Third of a Series)

Compactness in a pursuit engine has a real bearing on successful plane performance. Compactness means decreased overall length. This means increased maneuverability.

Maximum maneuverability in a pursuit plane and especially in a climbing turn is a vital factor to the fighting machine. The experience of this organization has led to the development of a highly compact unit in the Wright Pursuit engine, the only proven pursuit engine in the world which is in production today.



"The Identification of Incomparable Service"

WRIGHT AERONAUTICAL CORPORATION, *Paterson, N. J., U. S. A.*

WRIGHT

PURSUIT ENGINES

THE STANDARD PURSUIT ENGINE OF THE UNITED STATES

March 6, 1922

AERIAL AGE WEEKLY

Vol. XIV, No. 26

TABLE OF CONTENTS

The R-38 Report 607
The Roma Disaster 607
The News of the Week..... 608
The Aircraft Trade Review..... 609
The Roma Disaster 610
Air Transport for America..... 611
Report of the Aeronautical Research Committee on the R-38..... 613
Standardization in Aerodynamics.. 614
Aerial Transport Today and Tomorrow 616
Aero Club of Pennsylvania..... 618
Naval and Military Aeronautics.... 619
Foreign News 620
Soaring Flight 621
Aeronitis 622

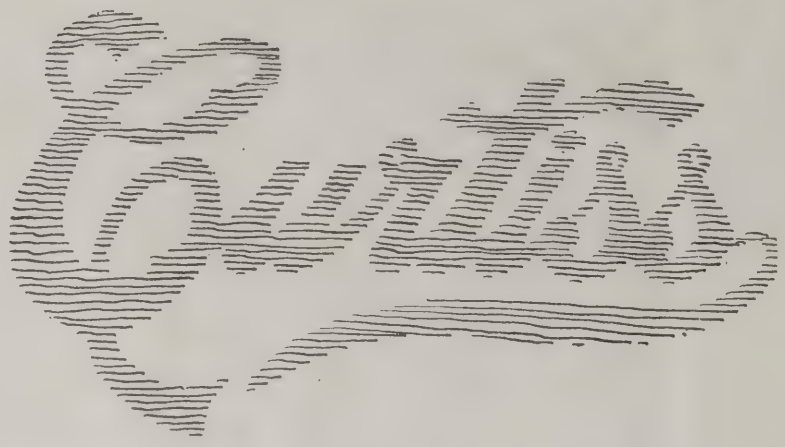
PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.
Printed in U. S. A.

Dealers wanted



DELIVERING a 3-place Lincoln Standard Tourabout to Messrs. Bell and Long of Kansas City, Mo., December 21st, 1921, at zero temperature. (Note the aluminum covering on lower half of the radiator.) On account of the extreme weather conditions their flying instruction was transferred to the Oklahoma City flying field.

Nebraska Aircraft Corporation
Lincoln, Nebraska



Announcing 1922 Price List

NEW PRODUCTION

	LIST PRICE
ORIOLE:	
With OX5 Motor	$3000.00 F.O.B. Buffalo, New York
With K-6 Motor (1919)	4400.00 F.O.B. Buffalo, New York
With C-6 Motor (1920) and large surfaces	4800.00 F.O.B. Buffalo, New York
SEAGULL:	
1919 K-6 Motor, dual stick control	5200.00 F.O.B. Garden City, L. I.
1920 C-6 Motor, dual dep control and balanced ailerons	5600.00 F.O.B. Garden City, L. I.
STANDARD:	
With C-6 or K-6 Motor	3600.00 F.O.B. Garden City, L. I.
MOTORS:	
C-6 or K-6 (150 H.P.)	3000.00 F.O.B. Buffalo, New York

GOVERNMENT TRAINING PLANES

JN's:	
JN4D with new OX5 Motor	$2400.00 F.O.B. Dallas, Texas
JN4A, B, C & D used, with overhauled OX5 Motor	$1200.00 to 2200.00 F.O.B. Dallas, Texas
STANDARDS:	
With new OX5 Motor	2000.00 F.O.B. Houston, Texas
With overhauled OX5 Motor	1700.00 F.O.B. Houston, Texas
Without motor, rebuilt for OX5	1100.00 F.O.B. Houston, Texas
Without motor, rebuilt for K-6 or C-6	1600.00 F.O.B. Garden City, L. I.
Without motor, as received from Government	800.00 F.O.B. Houston, Texas
MOTORS:	
OX5 New	800.00 F.O.B. Various concentration fields
OX5 Overhauled	600.00 F.O.B. Various concentration fields
OX5 As received from Government	500.00 F.O.B. Various concentration fields

NOTE: Where delivery is made from other than F.O.B. points, accrued transportation charges must be added.

WRITE FOR DETAILS IF INTERESTED IN BECOMING A DISTRIBUTOR OR DEALER, STATING TERRITORY DESIRED.

CURTISS AEROPLANE AND MOTOR CORPORATION

GARDEN CITY **LONG ISLAND, N. Y.**

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which Flying *is consolidated*

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Copyright THE AERIAL AGE CO., March 6, 1922

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIV NEW YORK, MARCH 6, 1922 No. 26

The R-38 Report

THE report of the British Aeronautical Research Committee upon the causes that contributed to the destruction of the dirigible R-38 (American ZR-2 after purchase) is authoritative because it reflects the judgment of eminent scientists who cannot be suspected of hostility to the Air Ministry. The Chairman of the committee is Sir Richard Glazebrook, Director of the Department of Aeronautics at the Imperial College of Technology, and the other members are representative specialists, one or more of them belonging to the British Air Ministry. The committee finds that "the accident was due to structural weakness in the design of the airship," for which the designers were responsible, chiefly because "no calculations were made of the stresses due to the aerodynamic forces to which the ship would be subjected." It is asserted, to illuminate this point, that "the calculations made by the design staff, taking specific account only of the forces and movements due to the distribution of weight and buoyancy, including gas pressures, were misleading."

It will occur to laymen reading the report that what seems like oversight on the part of the designers of R-38 was due to some extent to lack of practical experience in the operating of dirigibles. If they had sat by the side of pilots who steered and manoeuvred these great ships, they would have had a better understanding of the strain to which a dirigible is subjected in changing direction or in buffeting the wind. The British committee says: "The structure was not improbably weakened by the cumulative effect of reversals of stresses of magnitude not far short of the falling stress." On her three tests before the disaster, R-38 had developed structural weaknesses which, unfortunately, were not regarded as serious, and attempts were made by repairers to correct them. On the fourth and fatal trial, in which prominent aeronautical officers of both the British and American services lost their lives, the commander, Flight Lieutenant Wann, "was trying the ship on a few short turns to see how she answered her rudders." Fifty degrees of turn with fifteen degrees of helm had been completed, when the end came. He has testified that there was no abrupt reversal of the helm, that it was held amidships for a brief interval before being put over again. In short, care was exercised in operating the long cable controls. The framework of the ship, 698 feet in length, was too weak at the aft part of the hull to withstand the strain put upon it by the swing of the stern. This, by the way, was a finding of the court of inquiry ordered by the Air Ministry after the loss of the ship.

The British committee inclines to the opinion that "the limitations involved by the size of the shed in which the airship had to be built imposed too severe a task upon the designers." But in another paragraph it declared that "the existing methods of calculation at present in use for determining the scantling of structural members of an airship are insufficiently accurate for this purpose," and it is added that more exact methods should be developed. The conclusion must be that, like other designers of dirigibles, not excepting the Germans, whose Zeppelins have often gone wrong, the British are experimenters. The art of lighter-than-air ship construction is far from being complete.

The Roma Disaster

THE Roma disaster, with its lamentable sacrifice of valuable lives, is the last bit of evidence that Congress should need in urging the necessity of appropriating sufficient funds to develop our supply of helium. It may be argued that the use of helium would not have saved the Roma, but the crowning horror of the airship's bursting into flames would by its use have been avoided. So much is apparent in advance of inquiry, which must be searching in vital details of construction and operation.

There is no parallel between the accident to the R-38 and that to the Roma, for whereas the R-38 collapsed on a test flight, the Roma had made scores of trips in Italy prior to its being brought to the United States, and on its first long trip from Langley Field to Washington, it made a very creditable showing.

The report of the investigating commission will be awaited with great interest.



The News of the Week



Aeronautical Chamber of Commerce Elects Governors

New York—A meeting of the members of the Aeronautical Chamber of Commerce of Americameaadfla6fe rArks-rlmp of the chamber, 501 Fifth Avenue, on the afternoon of February 24th, 1922, for the purpose of choosing a permanent Board of Governors, representative of all of the varied aeronautical interests included in the organization, and perfecting the organization upon a permanent basis, commensurate with the size and scope of its entire membership and responsibilities.

The Aeronautical Chamber of Commerce, which includes in its membership practically all aviation interests—manufacturing, enigneering, operating and accessory—in the United States, is the culmination of the movement started nearly three years ago to co-ordinate the aeronautical trade into a well-balanced, truly representative trade body. Its efforts will be directed toward popularizing travel by air and the use of aircraft among civilians.

Samuel S. Bradley presided at the organization meeting as temporary President. Eleven Governors were chosen, representing all classes of membership, as follows:

C. C. Winter, President of the Airship Manufacturing Company.

Frank H. Russell, Vice-President, Curtiss Aeroplane and Motor Corporation.

John M. Larsen, President, J. L. Aircraft Corporation.

Grover C. Loening, President, Loening Aeronautical Engineering Corporation.

Samuel S. Bradley, General Manager, Manufacturers Aircraft Association.

F. B. Rentschler, President, Wright Aeronautical Corporation.

B. E. Bushnell, Director of Sales, Stewart Hartshorn Company.

Charles H. Colvin, General Manager, Pioneer Instrument Company.

Sherman M. Fairchild, President, Fairchild Aerial Camera Corporation.

Lawrence Sperry, President, Lawrence Sperry Aircraft Corporation.

Charles F. Redden, President, Aeromarine Sales and Engineering Company.

The various organizations represented by the Board of Governors indicate the wide scope of the Aeronautical Chamber of Commerce, including as it does, manufacturers, engineers and operators of both heavier-than-air and lighter-than-air craft, as well as manufacturers of accessories and supplies.

New York-Chicago Service Contemplated

In response to an invitation issued by Mr. E. P. Brinegar a meeting of representative business and professional men of New York, Chicago, Boston, Philadelphia and Washington was held at the Hotel Biltmore, New York, at 12:30 P. M. to-day.

The meeting was called to order by Mr. Brinegar and Major Charles J. Glidden requested to act as chairman.

The object of the meeting was to discuss the feasibility of an Air Mail and Merchandise Service between the cities of New York and Chicago.

A statement from President Harding to the Congress of the United States in the interest of aeronautics was read, also letters of encouragement from Hon. Edwin Denby, Secretary of the Navy; Hon. Will H. Hays, Postmaster General; Major General Mason M. Patrick, Chief of the Air Service; Rear Admiral W. C. Moffett, Chief of the Naval Bureau of Aeronautics; Rear Admiral W. F. Fullam, U. S. N. (retired); C. F. Marvin, Chief of the U. S. Weather Bureau; Congressman Hon. John E. Raker of California and others.

Addresses were made by the following persons:

Major Charles J. Glidden, chairman of the meeting; Hon. Halvar Steenerson, chairman Committee Post offices and Post Roads; Mr. Carl F. Egge, Superintendent of the Air Mail Service, representing the Postmaster General; Lt. Commander Donald Royce, representing the Secretary of the Navy and Chief of the Bureau of Naval Aeronautics; Col. John A. Jordan, formerly Chief of Construction of the Air Mail Service of the United States; Mr. Lee Olwell, National City Bank; Mr. W. G. Clark, consulting engineer; Mr. Joseph A. Steinmetz of Philadelphia; Milton A. Stone, Esq., of Boston; Paul M. Herzog, Esq. (Kendall and Herzog, attorneys), and others.

The following resolution was adopted:

That a Committee on Investigation and Permanent Organization be appointed by the chairman of which he shall be a member and that Kendall and Herzog act as legal advisors and Mr. W. G. Clark consulting engineer of the committee.

Associated Advertising Clubs to Investigate Aircraft Stocks

Taking cognizance of many complaints from investors who reported that they had been approached or victimized by professional promoters of aerial transportation schemes, the National Vigilance Committee of the Associated Advertising Clubs of the World, 110 West Fortieth Street, have sent out a bulletin to Chambers of Commerce and other organizations warning the public to investigate before purchasing aircraft stock. It became known that the committee had been gathering data about several promotion companies said to have been selling stock on promises which aeronautical engineers have declared impossible of fulfillment.

The Associated Advertising Clubs announced also that it had retained Jerome Simmons, who recently resigned as Assistant United States District Attorney here, is to take charge of investigations of aerial and other stock selling schemes of a questionable nature. Mr. Simmons will enter upon his new duties next week, it was announced.

The bulletin, whose heading is "Beware the Professional Promoter of Air Transportation Companies," says:

"It has come to the attention of the National Vigilance Committee that various professional promoters are active in many sections of the country, either in the sale of shares in air transportation companies, promising large returns to investors, or in setting up machinery which will enable them at some later date to sell interests in such companies.

"In some instances, promoters have gathered around them men of some aviation experience, who have thus far enjoyed good reputations, and have through the use of the names of these men and their past aviation experience bought or borrowed respectability to create confidence, without which the professional promoter is lost.

"In other instances, promoters have forwarded their plans for separating a gullible citizenship from its savings by the hurrah method of trading upon the community spirit of cities solicited to provide station sites and franchises that will 'put them on the air transportation map,' and inspire the envy of some legs fortunate rival city. This may lead to the appointment of an 'aeronautics committee' of the Chamber of Commerce to work for the coming of ships of the air, a form of recognition which amounts to endorsement. With news items in the local press, this provides the 'set-up' upon which promoters' agents will cash in when stock-selling time rolls around, as it inevitably does.

"Promoters of this type are as bold as they are resourceful. They intimate that Chambers of Commerce are financially backing their efforts; that rich capitalists are advancing all the money needed to do preliminary organization work; that profitable contracts with the Post Office Department and the express companies are practically in their pockets; and they talk glibly of 'Government co-operation,' and 'official connections.' These, and many other representations, which dazzle even skeptical City Fathers, have in them more of deception and fraud than of truth and honesty.

"Some of these promoters, bolder perhaps and more versed than others in the art of large-scale fakery, claim to possess planes, often juggling with the names of famous designers in a way to impress the layman. Such promoters may even have a plane or two, built to order, of course, for stock-selling purposes, but not fitted for freight and passenger carrying service at a profit.

"Even honest air transportation projects, from the viewpoint of investors, must necessarily be considered in the extremely speculative class until there is adequate Federal legislation regulating travel by air.

"Commercial aviation, the great, new development in transportation, is being put forward soundly by men of experience in aeronautics and in the automobile industry who have their feet on the ground. It should not be permitted to become a means by which weavers of fantastic schemes may enrich themselves at the expense of the public whose admiration and enthusiasm for a marvelous development make them easy victims for persons of predatory instincts."

Elaborating on the bulletin, H. J. Kenner, Director of the Vigilance Committee, said several of the stock selling projects that had been called to his committee's attention were such clever swindles that they made the get-rich-quick schemes of other days dwindle in comparison.

"Already we are hearing of persons who have paid their hard earned money to suave salesmen, who have promised them anywhere from 100 to 1,000 per cent. a year on their investment," Mr. Kenner said.

The AIRCRAFT TRADE REVIEW

Dayton-Wright School to Reopen

The Dayton-Wright Co. announces resumption of its training school which was abandoned upon our entry into the late war. Applications for enrollment are being received now for the course of training which is to be inaugurated in May and with a great many improvements, both in the matter of facilities and planes, over anything in the past.

With adequate boarding arrangements, the use of the improved Gosport system, instructor and student sitting side by side in the training plane and each pupil getting individual instruction, a large class is already looking forward to May.

Market for Planes in Japan

The American Consul at Nagoya, Mr. H. F. Hawley, writes as follows on the progress of aviation in Japan:

"American aircraft manufacturers should follow closely the developments in Japan, as considerable activity along the line of aeroplane construction indicates an increasing demand for such means of communication and possible opportunities for sale of aeroplanes.

The establishment of an aerial training school in Nagoya and the organization of the Lake Aerial Excursion Co. is contemplated by a civilian aviator of Kyoto. The latter is planning a visit to the United States for the purpose of purchasing a 400-horsepower 8-seater plane.

The reopening of a civilian aviation school at Nagoya, which was temporarily closed, is being planned.

Changes in Aerial Mail Service Personnel

The following changes in personnel have taken place at the Air Mail Office at Crissy Field: Mr. G. H. Colwell has resigned as Superintendent of the Western Division of the Air Mail and has been succeeded by Mr. C. A. Nelson, who has for some time past been Field Manager at the Salt Lake Field, as well as Assistant Superintendent of the Western Division. With this change Mr. Nelson has decided to move the headquarters from Crissy Field to the Salt Lake Field. The new assistant Superintendent, Mr. W. E. LaFollette, will be stationed at Crissy Field.

Mr. Newton B. Converse, a former aviation mechanic at Mather Field, has also resigned his position with the Air Mail Service, and will be succeeded by Mr. Porter D. Bush, a former Air Mail Service employe at the Chicago Field.

Western Parachute Co. Active

Duncan, Okla.—As a result of advertisements carried in the *Aerial Age Weekly* the Western Parachute Company of this city has been busy manufacturing and shipping their novel new parachute to all parts of the United States.

This parachute is made in two sizes, of cambric cloth. The five-foot model is designed for delivering bundles of newspapers, merchandise, etc, from a flying aeroplane. The larger or twelve-foot model is especially designed for the exhibition flier, who this year is incorporating more new and novel stunts in his program than heretofore by demonstrating that live animals. monkeys, dogs and kittens, can be delivered safely to the ground regardless of wind conditions.

The new idea of using substantial small parachutes to a much greater degree is demonstrated in the receipt of orders of individual aviation concerns for as many as a dozen of each type.

The Aerial Mail Appropriation

Postmaster General Will H. Hays appeared before the Senate Appropriations Committee February 23 in an earnest appeal for the restoration of the appropriation eliminated by the House General Appropriations Committee for air mail.

The sub-committee of the House reported $1,935,000 for the next fiscal year, but the General Appropriations Committee of the House struck out the item and failed to make any provision for the continuation of the Air Mail Service at all.

In presenting the matter, the Postmaster General said: "It is not so much the length of the step as the direction of the step that is important in anything, and it is a step in the wrong direction, in my opinion, to abandon all Air Mail Service. Much progress had been made in the development of the air mail against heavy odds prior to this last year, and still further sound and safe progress is being made. The possibilities of improving the service with experience is indicated by the fact that there has been but one fatality in the last million miles flown, while in the last fiscal year there were seventeen fatalities in a total of 1,770,000 miles.

"The future of the country is in the air. The Air Mail Service is of great value, per se, and is, in addition, of tremendous potential value as a defense reserve is case of necessity. Commercial air activities may be ultimately developed in a way to provide this service. This will not come in the next fiscal year, and by all means a reasonable effort, consistent with proper expense and certain safety, should be made to develop the Air Mail."

The Air Mail Service appropriation asked for the fiscal year 1921	$2,200,000
The amount reported by the House Committee	1,935,000

The Air Mail item was eliminated from the Post Office Appropriation Bill by the General Appropriation Committee, Congressman Madden, Chairman. The Senate has been asked to restore this item.

The amount of money expended for Air Mail Service last fiscal year was $2,600,000. Of this amount $1,245,000 was expended from the Railroad Transportation Appropriation. The Air Mail Service Appropriation for last year was $1,375,000.

The appropriation for the current fiscal year is $1,425,000. We are not using other appropriations and it is possible that the service may have to be curtailed to some extent before June 30th, although an effort is being made to fly six times a week without a deficit. Since July 1st, the personnel has been reduced from 521 to 448, a reduction of 73 employees, whose annual salaries amounted to $127,075. It is proposed to make further reductions in the personnel.

We now have 53 ships in flying condition and 20 undergoing repairs. Major repair work at a number of the fields has been ordered discontinued in the interest of economy. We are purchasing only material which we have reason to believe will be used before June 30. At the close of the present fiscal year, it is estimated that we will probably have not to exceed 25 ships in flying condition and our stock of supplies will be reduced to a minimum.

The appropriation for the fiscal year 1923 must be greater that that for the current fiscal year to insure satisfactory service, for the following reasons: On July 1st, we will be practically out of supplies and material; it will be necessary to immediately employ a large force of mechanics to bring our ship situation up to normal condition, which we figure is 50 ships. The equipment received from the Army at the present time is not in good condition. All wings need repairs; damaged longerons must be replaced in many ships received; the Army stock of propellers suitable for our use is exhausted, and the same is true as to landing gears, gasoline tanks, tail skids, radiators, shutters, and many other accessories.

Miles traveled current fiscal year, July 1 to January 31..	1,029,056
Number of letters carried....	25,496,560
Percentage of performance:	
Trips completed	93.12%
On a mileage basis.....	94.27%
Number of ships in the air daily	21
Miles flown with mail daily....	5,360
Estimated mileage for year....	1,800,000
Number of fields (all fully equipped	15
Number of radio stations (all except Rawlins, Wyoming)..	14
Estimated value of equipment on hand	$1,500,000

No fatal accidents have occurred in the current fiscal year on mail flights. More than one million miles have been flown since last fatal accident, which occurred on July 16 on a ferry trip. Pilot was ordered to take a ship from San Francisco to Reno. He fell on the home field at San Francisco.

Colonel Shaughnessy introduced a "safety-first campaign" and insisted that safety must be given consideration over percentage of performance. His policy has been carried out with very good results as shown above. During the last fiscal year ended July 1, 1921, 1,770,658 miles were flown and there were 17 fatalities—13 pilots and 4 mechanics. An average of one fatality for each 104,156 miles flown.

It is believed that if the Senate restores the Air Mail item the full amount, namely, $1,935,000 should be restored. The estimates for the year 1923 were very carefully prepared and it is the Department's opinion that it will require practically $2,000,000 to fly the Transcontinental Route safely. It would be better to discontinue the service if we cannot fly ships in good condition.

THE ROMA DISASTER

IN the greatest disaster that ever befell American military aeronautics, thirty-four men died February 21, when the army dirigible airship Roma plunged a thousand feet and crashed to earth in flames near the Hampton Roads army base. Only eleven of the forty-five men aloft with her were saved, and some of them were terribly hurt. Three were slightly injured.

The breaking of the rudder with its vertical controls, affixed in box-kite fashion to the stern, is believed to have been the original cause of the disaster. Its more horrible phase came just as the stricken craft plummeted into the earth. The metal clad nose struck high-tension electric power wires, and with a flash and a roar the dirigible was fired from stern to stern.

Only those whose fortunate positions in the car enabled them to take the desperate hazard of a leap before the flames ran with lightning speed through the gas bag, more than two New York City blocks long, had much chance for their lives. The thirty-three who couldn't jump died. An officer broke his neck in a dive to earth and was dead before he could be got to a hospital.

Captain Dale Mabry, commandant of the Roma and principal pilot, died with his hands on the wheel. He stuck to his post to the last. The clothes were found burned from his body and the flesh from his fingers, but the fingers still grasped the wheel of the aircraft.

The crushed, misshapen mass that thudded onto the field was a funeral pyre of such intense heat that the agonies of those who were not killed in the crash must have been mercifully brief. The bodies were burned beyond recognition and the slow work of listing the victims was carried out partly by a process of elimination and partly through noncombustible objects that the aviators had carried in their pockets. That list when it was completed showed that two Majors, four Captains and seven lieutenants were among the lost.

Horrified watchers, some of them veterans of gallant affairs abroad, rushed toward the blazing wreckage. Blistering heat halted them in their tracks. Some had associates among the ill-fated crew, others were actuated by all the traditional daring of the service—but those walls of heat were beyond human penetration. Not until three fire departments, mobilized at breakneck speed, had exhausted their chemicals and the twisted aluminum metal work was losing its red glow could any one approach. Then there remained only the gruesome job of extricating charred bodies.

The fire burned in the wreckage nearly five hours and it was not until seven o'clock that it was entirely extinguished and the service men could penetrate far enough to take out all the bodies. The work of examining the débris was completed shortly after nine o'clock with the total number of dead officially placed at thirty-four.

Things might have been different had the Roma's gas bag, with its cubical capacity of 1,100,000 feet, not been filled with hydrogen. Non-inflammable helium was the levitating gas used when the Roma, which was bought from the Italian Government, went on her first trial flight here last December. But it had been planned to send the ship—the largest semi-rigid airship in the world—on a Spring cruise over the country to demonstrate her fitness to cross the Atlantic. In her bag had been the whole available supply of helium in the United States. Flying officials wanted that for the Spring journey, so they pumped it into tanks and substituted hydrogen.

The occasion for today's flight that was to prove so tremendous a blow to lighter-than-air flying was a desire to test the Liberty motors which had been installed to replace the Italian motors, which functioned poorly in the cold that marked the brief trial flight last December.

List of Dead and Survivors

THE DEAD

Major John G. Thornell, Air Service; Langley Field.
Major Walter W. Vautsmeier, Coast Artillery Corps; assigned to Air Service; Rockwell Field, Cal.
Captain Dale Mabry, Air Service; Langley Field.
Captain George D. Watts, infantry; assigned to Air Service; Ross Feld, Cal.
Captain Allen F. McFarland, Air Service; McCook Field, Ohio.
Captain Frederick R. Durrschmidt.
Lieutenant John R. Hall.
Lieutenant Wallace C. Burns.
Lieutenant William E. Riley.
Lieutenant Clifford E. Smythe.
Lieutenant Wallace C. Cummings.
Lieutenant Ambrose V. Clinton.
Lieutenant Harold K. Hine.
Master Sergeant Roger B. McNally.
Master Sergeant Murray.
Sergeant Lee M. Harris.
Sergeant Lewis Hilliard.
Sergeant Myron G. Field.
Sergeant Thomas Yarborough.
Sergeant Billy Ryan.
Sergeant Virgil C. Hoffman.
Sergeant Shumaker.
Sergeant Holmes.
Master Sergeant Homer Garby.
Sergeant Heveron.
Private Kinston.
Private Thomas M. Blakeley.
Private Thompson.
Private Marion Hill.
Civilian Stryker.
Civilian Hanson.
Civilian O'Laughlin.
Civilian Merriman.
Civilian Schulenberger.

THE SURVIVORS

Major John D. Reardon, wife, Mrs. Reardon, 300 Elm Street, Washington, D. C.

Captain Walter J. Reed; father, William J. Reed, Scarsdale, N. Y.

Lieutenant Clarence H. Welch; father, W. V. Welch, Papillon, Neb.

Lieutenant Byron T. Burt, Jr.

Sergeant Virdon T. Peek; father, Howard Peek, 2304 Lafayette Avenue, Terre Haute, Ind.

Sergeant Harry A. Chapman; mother, Mrs. J. H. Ward, 1626 Frederick Avenue, St. Joseph, Mo.

Sergeant Joseph M. Biedenbach; father, John Biedenbach, 411 East Market Street, Akron, Ohio.

Corporal Albert Flores.

Civilian Walter A. McNair, Bureau of Standards, Washington, D. C.

Civilian Charles Dworack, McCook Field, Ohio.

Civilian Ray Hurley, National Advisory Committee on Aeronautics.

The Roma disaster will be the basis for a vigorous fight in Congress for sufficient funds to develop helium, the non-inflammable gas, which chemists of the Bureau of Mines have been experimenting with and which the government has been producing in small quantities in two plants in Texas.

Army and navy aviation experts, with members of Congress who believe that the death list of the Roma was due largely to the use of the highly explosive hydrogen gas in the envelope, resumed a movement for additional Congressional appropriations to carry forward the work the government has been doing toward acquiring an adequate supply of helium to inflate all the airships of the military arm of the government.

$800,000 Appropriation Sought

Representative F. G. Lanham, of Texas, who has advocated persistently the appropriation of funds to carry on the helium plants of his state, said to-day that he will seek an appropriation of $800,000 for this purpose.

Chairman Julius Kahn of the House Military Affairs Committee declared that the accident to the Roma should not deter the government from continuing its work in development of aircraft of all types.

Army and navy flying officers said they would urge Secretaries Weeks and Denby to make strong recommendations to Congress for funds to acquire sufficient helium to inflate all the lighter-than-air craft of both arms of the service.

In the meantime a special board of air service officers, named by Major General Mason M. Patrick, chief of the air service, will make an investigation to ascertain, if possible, its precise cause. This board is made up of Majors Davenport Johnson, president; John H. Jouett and George T. McNarney.

Experienced Crews Necessary

Air service officers pointed out that the history of lighter-than-air craft of the larger type established the fact that the crews employed should be men who have had years of experience in the construction, operation and maintenance of the ships. They declared that the Roma was successfully operated in Italy, both in war service and after peace had been declared

United States experts, however, have had little experience in operating the huge ship.

Reference also was made to the experience Great Britain has had with two huge ships. The R-34, which made a successful flight to this country, was not structurally defective, but it has perished. The ZR-2, also known as the R-38, cost $2,000,000 to build and was thought to be the last word in lighter-than-air construction, but this ship buckled amidships on its final trial flight, just before being turned over to the United States, and carried forty-two officers and men to death.

The use of helium, according to air service officers, is essential to the successful development of vessels of the type of the Roma and the British dirigibles. While not maintaining that the fate of the Roma would have been prevented had helium been used, air officers hold that the casualties undoubtedly would have been fewer. No airship, however, could have withstood contact with the wires carrying 2,300 volts of electric current.

Kahn Says Development Must Go On

Chairman Kahn agreed that further efforts in the way of developing lighter-than-air craft must go on. "We have made great strides in recent years," Mr. Kahn said, "especially with the development and use of helium gas. It is hoped that we will be able to obtain enough of this substance to fill all of our lighter-than-air machines.

"While I realize that the whole country will be deeply stirred by this accident, I feel that those who perished are but martyrs to the cause of aviation. The world probably will continue air flights, notwithstanding the disaster.

"The chances are that efforts will be made to prevent a recurrence of such a calamity. I feel, however, that so long as the other nations of the world continue experiments regarding flights in the air our own country will have to keep up to the rest of the world in that regard."

Responsibility for the Roma disaster was placed directly on Congress to-day by Lieutenant C. S. Tinker, of the naval reserve force, who is a consulting engineer in civil life. Tinker was to have made the flight from England to the United States on the ZR-2 as the official representative of the Navy Department. He declared to-day had the British ship been inflated with helium an accident would not have happened. The collapse would have occurred, he said, but the envelope would not have been destroyed by fire.

Secretary Weeks said:

"Necessarily I must await the results of the official investigation before forming any opinion as to the cause of the dreadful disaster. I am greatly distressed over the loss of the splendid ship and so many fine officers and men. My deepest sympathy goes out to the families of these martyrs to the development of aviation.

"Aviation naturally is a dangerous art. Accidents are expected to happen, either to personnel or equipment. Right now there are one hundred damaged aeroplanes at Kelly Field, Tex., awaiting repairs.

"All this explains why I told the Military Committee the other day that I felt little enthusiasm for the proposal to turn over flying equipment to National Guard units. In all probability many bad accidents would follow, with numerous casualties and much damage to costly equipment. It is bad enough to have these things happening in the regular flying services and they always give me great distress."

Referring to the loss of the semi-rigid airship Roma, the Aeronautical Chamber of Commerce of America, 501 Fifth Avenue, New York, including in its membership practically all of the aviation interests in the United States, stated:

The loss of the Roma should not be regarded as a reflection on the operating personnel or the judgment of the War Department in having purchased it from Italy. It was the obvious thing to do; because we have not developed lighter-than-air craft in this country to the extent that other Governments have developed it with public funds. The accident should be regarded the same as accidents in a laboratory. The potentiality of the airship is so great that it is bound to be developed, despite an accident or a series of accidents. It is so important and its promise is so far-reaching in transportation and in national defense that it must continue.

We do not abandon our laboratories, mines, railroads or steamships when accident befalls them. The accident to the Roma may indicate our future course of procedure. There are now several important airship projects in the United States. They are being developed with all possible care. We are advised today that they will not be abandoned. This is fortunate. In future, helium, the non-explosive gas, will no doubt be used instead of the dangerous hydrogen. Our airships will be built in this country and our personnel organized and trained in their construction from the drafting board to the navigation of the finished product.

AIR TRANSPORT FOR AMERICA

By CLIFFORD ALBION TINKER*

IT'S a year and a half ago that *The Nation's Business,* making one of its rare plunges into fiction, told the story of the formation of an air transport company to run great dirigibles from coast to coast in less than forty hours.

In another year, if the plans of the men back of a new company do not miscarry, lighter-than-air ships will make their trial trips across country. The company has been incorporated, capital enlisted, patents acquired and preliminary planning completed. So far the fiction of 1920 has become the fact of 1922.

The editorial prediction then was:

While the treatment is fanciful every detail is an accomplished fact or is under experimentation. Most of those that are not facts now will be within five years.

One of the men active in the compnay's plans is Benedict Crowell, formerly Assistant Secretary of War, head of the American Aviation Mission to Europe and president of the Aero Club of America. Let him tell the company's plans:

"Our aim," said Mr. Crowell, "is to provide rigid airship service to America first, and, as time goes on, link this continent with the rest of the world by aerial routes; a service supplementing existing methods of transportation, one which will traverse space in a minimum of time and supply a means of travel both safe and comfortable.

"Aerial transportation is just as necessary to present-day civilization as the railroads were to civilization fifty years ago. In no country in the world is this new method of transportation more necessary than in the United States because of its great expanse of territory and its numerous urban centers of large size. The United States can and should lead the world in the rigid airship field."

Mr. Crowell was one of a party of financial men and engineers who spent in Europe much of the spring and summer of 1921. They went to airship factories and stations in Germany, France, England and Italy. They made flights in British ex-German and Italian airships, secured data covering manufacturing and operating costs not only of airships but of hangars, mooring masts, landing fields, and terminal facilities. They secured information and engineering data respecting flights over routes in the countries named, passenger accommodations, freight and express handling, fuel and supply statistics, replacement costs, insurance rates, and the laws governing air navigation in Europe.

"At the same time," Mr. Crowell explained, "we were carrying on investigations here in the United States. We looked into the helium question, its cost and probable supply; sources of operating revenue, passenger, freight, express and mail; the most feasible routes over which to start our new service to supplement existing traffic facilities; meteorological data and the effect that our climate will have on a yearly operation schedule; and the thousand and one things which develop into real problems to be surmounted in any undertaking of such wide application."

In their investigations, the representatives of the corporation had the cooperation and assistance of Dr. Johann Schuette, of the Schuette-Lanz Airship Company of Germany, and corps of his engineers, also various engineers and associates of other airship authorities of Europe. Doctor Schuette had been in America in the spring of 1920 as had officials of the Zeppelin Company, and the information gained from them was of material service in the first formal step, the organization of the American Investigation Corporation.

"We uncovered enough evidence early on our trip to Europe taken with that previously found," said Mr. Crowell, "to convince us all that the time had arrived for action; that certain conditions abroad, if taken advantage of, would place the United States in the lead in the airship industry, perhaps for all time. Political conditions, reduced rates of exchange, post-war reparations, the non-employment of airship talent, all these were factors in giving airships a setback in Europe. These factors are to our advantage."

Reprinted through the Courtesy of *The Nation's Business.*

On the return of these investigators from Europe, plans were formulated for the organization of General Air Service which starts business with all the accumulated data acquired by the American Investigation Corporation. The latter corporation has acquired various rights for the construction of German rigids throughout the world, secured options on certain equipment vital to the industry, including mooring masts, hangars, terminal apparatus, and plans and specifications for rigid airships of various capacities for long-distance routes.

Dr. Schuette is again in this country. This second visit has made possible the incorporation of General Air Service and made more definite its plans. The first line the company hopes to put into operation will be from New York to Chicago, to be extended to Pacific coast cities as soon as additional ships can be built. The New York-Chicago line will be opened by two ships, each of approximately 4,000,000 cubic feet capacity, these ships to be fabricated in Germany and erected in the United States. They will provide adequate accommodations for 100 passengers and 30 tons of mail and express matter. It is planned to build larger ships for lines to South America and Europe when the facilities for complete construction have been gathered in America.

The men who look so confidently forward to a commercial airship service that shall supplement our land and waterways are hopeful not only of sympathy, but of active support from the authorities, both of the Army and Navy. They believe that the Government will permit the use either of the Navy hangar at Lakehurst or the one at the Cape May Naval Air Station and the Army hangar at Scott Field near Chicago so that ships of the new company may be erected while its own housing and terminal facilities are under construction.

Mr. Crowell points out that the General Air Service ships would be available for training dirigible personnel in peace time and immediately serviceable as auxiliary in time of war.

Their hope of federal cooperation does not stop with that. They feel that a contract, mutually advantageous, might be made with the Government, permitting these still unborn dirigibles to be filled with helium. They hold out the suggestion that their ships would be in effect great storage vessels for helium now going to waste or not in use and that their experiments in handling the gas would be of direct service to the Government. The record flight of the helium-filled Navy blimp, the C-7, was added proof of the part this non-inflammable gas is likely to play in the future of air navigation.

But let Mr. Crowell justify this project which, fantastic as it sounded when The *Nation's Business* first told it as fiction, has yet enlisted the support of men of business.

"The unit of life today is *time* not *distance*. Therefore the vehicle employed in reducing the time required to cover a given distance is of immense importance to the business world. That is where the airship comes in. It is essentially a long-distance craft, and that is why we will have no competition on long-distance traffic—airships are distinctly in a class by themselves. The running time of General Air Service liners will be ten hours from New York to Chicago and only forty hours from New York to the Pacific coast. Think what this means to business dealing in express shipments where time is a factor."

Who are the men who have pledged the help of time and money to this General Air Service? We have named one or two. Besides Mr. Crowell, Owen D. Young, vice-president of the General Electric Company; J. Reading Bertron and Snowden A. Fahnestock, of Bertron, Griscom & Co., have been actively interested almost from the beginning. The names of R. B. Mellon, Marshall Field, Franklin Roosevelt, E. M. Herr, president of the Westinghouse Electric and Manufacturing Company; Arthur V. Davis, of the Aluminum Company of America; Samuel McRoberts, president, Metropolitan Trust Co., Wm. B. Joyce, president, National Surety Co.,—these are taken at random from the list of Subscribers to the American Investigation Corporation, and who are actively interested in the operating company.

But after all this is not the story of a commercial enterprise, it is the story of an idea—an idea which saw light in this magazine nineteen months ago and which has taken one step towards reality.

REPORT OF THE AERONAUTICAL RESEARCH COMMITTEE ON THE R-38

THROUGH the enterprise of the New York *Times*, American readers were made aware of the context of a report issued by the Aeronautical Research Committee of Great Britain on the accident which resulted in the entire loss of the R-38 on August 25, 1921, before that report became available to the British public.

The Aeronautical Research Committee, which corresponds in England to the American National Advisory Committee for Aeronautics, of which Dr. Charles D. Walcott of the Smithsonian Institution is Chairman, is a scientific committee sanctioned by the Royal Air Ministry, which, because of its particular ability to pass judgment on the scientific aspects of the problems involved in the destruction of the R-38, was asked to investigate and report its conclusions to the British Government.

The personnel of the committee embraces representatives of the British Royal Aeronautical Society, the British Society of Aircraft Constructors, representatives of the British universities and the British Air Ministry. During the sessions of the committee the American Navy Department had two representatives present as observers. These latter, Commander H. T. Dyer and C. P. Burgess, the latter of the Aircraft Design Department of the United States Navy, are still in England in connection with the investigation which this Government is making into the cause of the R-38 disaster.

The report of the committee points out, however, that the British Air Ministry has recently approved the formation of a panel of the Aeronautical Research Committee having terms of reference to consider the validity of the methods at present in use for calculating the strength of rigid airships and to endeavor to indicate other methods which would enable a closer basis of design to be obtained.

The Aeronautical Research Committee went thoroughly into every aspect of the wreck of the R-38, holding hearings, examining survivors, designers and others, and also had the use of the data which had been assembled in the British Air Ministry's own independent investigation of the disaster previously made.

The committee's report declares that during the manoeuvres of the R-38 on its fourth flight, when the accident occurred, the structure of the airship failed between the ninth and tenth frames, the ship broke into two portions, the forward portion caught fire at the fracture at the moment or shortly after separation, and that the fire spread rapidly, due to the presence of escaping petrol in the keel. An explosion followed, which led to the collapse of the structure and the ignition of liberated hydrogen gas, and a second explosion occurred when the forward portion reached the water.

The report says that the R-38, having due regard to her size and speed, was considerably weaker than the R-33, and that the provision of specially powerful control surfaces of new design virtually accentuated this weakness. These enlarged control surfaces have too great an area, it is held, for the sharpened cone tail section of the main body. Consequently, when stresses from the rudders and elevators were transmitted to the framework the latter proved too weak to withstand the torque, or twist, transmitted to it.

The committee asserts that "it thus appears to be clearly established that the R-38 had an insufficient margin of strength to withstand the stresses due to manoeuvres which might occur during normal flight, or due to bad weather.

The committee also reports that "in the stress calculations which were made by the (English) design staff, however, the airship was assumed throughout to be in the static buoyant condition; the stresses which would be imposed due to the additional air pressures when in flight were not calculated." In the simplest possible words the R-38, it is contended, was designed to remain still, to be in her shed and was not designed to take the air, or to fly.

The committee also concludes "that the factor of safety of R-38 as regards resistance to stresses due to aerodynamic forces, arising in flight, whether during normal manoeuvring in calm weather or when navigating in disturbed air, was roughly one-half that of R-33, although the prevalent impression at that time was that no material alteration from previous practice had been made in this respect."

This statement, in connection with a further statement that incomplete tests upon the R-38 "showed unexpectedly high fin pressures" indicates that to the weakness of structure, owing to faulty design, was added unsuspected high pressures due to poorly designed fins.

When the committee reports that "as to the effect of fins,

even at angles of yaw not above 10 degrees, very considerable pressures existed at the bow and stern of the ship, while amidships, the pressure was less than atmospheric," and that "such a distribution gives rise to large bending moments and shearing forces," it is not only explanatory of the disaster to the R-38 but may be applied equally well, it is said, to the physical situation obtaining on the box triplane tail section of the Roma.

Disregard of the results of tests made upon models and the first principle of calculations of aerodynamic forces and moments based upon these forces is alleged, but it is not overlooked by air experts in Washington that great progress has been made in airship design and construction since August, 1918, when the R-38 was laid down.

The committee minces no words in its criticism of the design staff of the British Admiralty. It leads its summary with the very frank expression "that the accident was due to structural weakness in the design of the airship" and then proceeds to emphasize, in technical terms, that the R-38 was not overloaded with cargo weight during her final flight, that she was slower and weaker than the smaller, previously designed R-33, that her new steering surfaces were too large and accentuated her structural weakness, that the designers ignored the aerodynamic forces to which the ship would be exposed in flight and that the calculation made by the design staff on these factors alone and the distribution of weight and buoyancy, including gas pressures, were misleading.

Admitting the instability of the R-38 and the apparent overbalance of her control surfaces, the report charges that wide movements of the control were necessary to keep the R-38 on any given course. The failing stress, or collapsed point of the structure as designed, was almost reached by the combined effect on the physical structure of the ship of reversals of stress such as might be expected in any other than dead calm weather.

The committee infers that first principles in design were ignored by the design staff and that not only the method of calculation used when the R-38 was laid down, but also those at present in use for determining the scantilings of the structural members of an airship are not accurate for this purpose, and that more exact methods should be used. It asserts that the design staff did not give detailed consideration to data available at the time of construction.

The report admits "the presence of a certain amount of softened duralumin in the airship," but insists that faulty material did not contribute to the accident, nor is the weather at the time of collapse held to be a contributing factor.

Dealing with the strength of the airship and the tests to which it was subjected, the report says:

"It thus appeared to be clearly established that R-38 had an insufficient margin of strength to withstand that stresses due to manoeuvres which might occur during normal flight, or due to bad weather.

"In view of this conclusion and since there appeared to be no good grounds for regarding atmospheric conditions as contributing to the accident, it became of importance to examine the nature of the manoeuvres which the ship had undergone prior to the accident, particularly on the last flight and immediately before the accident.

"During the first and second flights the speed of the ship and the manoeuvres through which she was put were not such as to subject her to very severe stresses. On the third flight, however, it was found that when the speed was increased to 50 knots there was difficulty in keeping a steady height, and 'hunting' through a range of 500 feet took place. This was corrected in great measure, but immediately afterward word was received in the control car that certain girders amidships had failed.

"The opinion that this failure was due to the action of the slipstream of one of the air screws in causing pressure on the structure is not accepted. The committee has formed a different opinion as to its probable cause. The general direction of the slipstream is parallel to the surface of the ship, and its action would not produce appreciably increased pressure, whereas the fact that the ship 'hunted' implied large movements of the elevators in navigation.

"Furthermore, the stresses in the ship due to movement of the elevators would be accentuated by the additional stresses due to gas pressures involved in the rapid changes of height as a result of 'hunting.' The committee is of the opinion that the buckling then reported was significant as being the first indication of the existence of dangerous stresses, and that the action of Flight Lieutenant Pritchard, who steadied the ship and relieved these before the failure spread, thus saved the ship.

"From the evidence, it is clear that, during the last half hour before the accident, the ship was swinging about at an approximate straight course, executing, alternately, partial turns to port and starboard. As to the magnitude and the rapidity of the movements of helm, evidence in detail has been taken.

"From a consideration of the observed pressures over the rudder the committee deduce that during the last half hour of flight there was at least one occasion when the rudder was moved fairly rapidly through an angle, the magnitude of which, as far as it affected the bending moment on the ship, was equivalent to about 20 degrees either in straight flight from the amidships position or in circling flight from some position on one side of the amidships position. The actual movement of the rudder might have been greater or less than this, according to whether or not the airship had a swing on at the time the rudders were put over.

"Since, as will be seen later, the evidence before the committee shows the movement of the controls to have been legitimate, the accident is ascribed to the strength of the structure being inadequate.

"It is not impossible that the process of failure was gradual and that the final breakage was the cumulative effect of a number of reversals of stress of magnitude not far short of the failing stress."

As to the materials used in the construction of the airship the report says:

"The question of the possibility of the accident having been due to faulty structural material has been examined. Many samples of material taken from salved girders and joints have been subjected to microscopical examination, chemical analysis and mechanical test at the N. P. L. With the exception of certain of the plates employed in making up girder joints all the samples gave results in accordance with the specifications.

"Tests of web plates taken from three salved joints, two of which had two plates each and one had four, showed that one of the plates at each joint was in the soft condition. It was found possible to bring these plates to normal strength by applying the proper heat treatment. Nevertheless, it is thought that these plates did not contribute to the accident, since the parts found soft were not apparently subject to heavy tensile stress, and no evidence was found of defective material in the airship except as above.

"Although the committee does not consider it probable that the accident was connected with the existence of these soft web plates, their presence in the ship indicates a certain lack of supervision during some period of the construction. Several samples of plate taken from the store of the Royal Airship Works, Cardington, subsequently to the accident were found to meet the requirements of the specification, and it would appear probable that the softening was effected during the construction of the ship.

"Toward the end of the construction of R-38 a limited quantity of 're-conditioned' or re-melted duralumin was made at Cardington and rolled into sheet. Some of this was used for subsidiary parts of the structure of R-38, but none was used on the main structure. In all cases of tests of this material it satisfied the requirements specified for duralumin.

"The committee considers that under the most efficient system of manufacture a material as sensitive to heat treatment as duralumin is can provide a reliable airship structure, but the stringency of the conditions required add greatly to the necessity for careful and constant supervision during construction.

"Among the points noted in the findings of the Court of Inquiry, held immediately after the accident to R-38, was the fact that the outbreak of fire in the forward portion was mainly responsible for the large loss of life; and further, that the fire probably originated in a spark from the electric leads, which became fractured at a point in the immediate vicinity of a similar fracture in the petrol mains.

"The committee accept the findings of the court in this connection, and wish to emphasize the desirability in future airships for all possible precautions to be taken to prevent the occurrence of sparks at fractured electric cables, and also of arranging the line of electric leads so that it is as remote as possible from the petrol mains."

In a summary of its conclusions the committee say:

"The committtee have examined the essential witnesses and have studied the reports of the Court of Inquiry and of the Admiralty committee appointed to investigate the history of the design and early stages of construction and in addition have pursued their own investigations. They have arrived at the following conclusions:

"I. That the accident was due to structural weakness in the design of the airship.

"2. That during the final flight no loads were imposed in

excess of those which might have occured during the normal navigation of the ship in weather which might reasonably be encountered.

"3. That, having regard to her size and speed, R-38 was considerably weaker than R-33.

"4. That the provision of specially powerful control surfaces of new design virtually accentuated this weakness.

"5. That no calculations were made of the stresses due to the aerodynamic forces to which the ship would be subjected.

"6. That in consequence, the calculations made by the design staff, taking specific account only of the forces and moments due to the distribution of weight and buoyancy, including gas pressures, were misleading.

"7. That, owing to instability of the ship, combined apparently with overbalance of the control surfaces, the movements of the controls necessary to keep the ship on any particular course were comparatively larger.

"8. That the structure was not improbably weakened by the cumulative effect of reversals of stress of magnitude not far short of the falling stress.

"9. That for the progressive development of airships in size, and speed reference to first principles in design is necessary, and that it is not sufficient to place exclusive reliance on comparison with existing chips.

"10. That the existing methods of calculation at present in use for determining the scantlings of structural members of an airship are insufficiently accurate for this purpose and that more exact methods, the outline of which can at present be indicated, should be developed. (Note: The Air Ministry have recently approved the formation of a panel of the Aeronautical Research Committee having terms of reference to consider the validity of the methods at present in use for calculating the strength of rigid airships and to endeavor to indicate other methods which would enable a closer basis of design to be obtained.)

"11. That research by both model and full-scale experiment is essential to determine and verify the forces to which an airship is subjected.

"12. That the terms of the requirements laid down in time of war for R-38 were extremely drastic and that the limitations involved by the size of the shed in which the airship had to be built imposed too severe a task on the designers.

"13. That at the time when the design was originally laid down information as to aerodynamic forces existed, which should have led to a more detailed consideration of the effects of these forces and to consultation with the Advisory Committee for Aeronautics as to the dangerous loads foreshadowed by the early model experiments on aerodynamic pressures.

"14. That in spite of the presence of a certain amount of softened duralumin in the airship, faulty material did not contribute to the accident.

"15. That on the assumption made, the structure was designed with great skill and the necessary calculations were carefully carried out by methods admitted as sufficiently accurate in other branches of engineering practice.

"16. That the weather at the time did not contribute to the accident.

Resistance Less Than R-33

As to precautions by the designers, the report says:

"Weekly conferences of the design staff of the Royal Airship Works were held during the construction of the ship, but it should be noted that the basis of calculation of the strength of R-38 was never officially discussed by experts other than those serving under the late Mr. Campbell. Nevertheless, the lack of aerodynamic data was known to Mr. Campbell, who pressed for full scale experiments to determine these.

"At the request of the Airship Design Department of the Admiralty, an investigation had been undertaken by the National Physical Laboratory in order to obtain information regarding the aerodynamic characteristics of R-38. A report (Note—T 1470. Experiments on a model of an airship of the R-38 class—By R. Jones, M. A., and D. H. Williams, B. Sc.) dated May, 1920, was issued which indicated that the resistance of R-38 compared unfavorably with that of R-33; that fins also appeared to be less effective than those of R-33. This report showed that an examination of the stability of the airship showed that, though somewhat unstable, her stability was an improvement upon that of R-33 and, moreover, that her controls were much more powerful. In spite of this, as observed previously, she proved, in fact, to be less controllable than R-33."

The committee says in reference to the relative strengths of R-38 and R-33:

"If the bending moments on airship due to aerodynamic forces only are considered, the committee estimate that the increase in the strength required by R-38 over, say, R-33 on account of the larger size of R-38, should have been 26 per cent., while that required on account of the greater speed should be 39 per cent., a net increase of 65 per cent. The assumptions made in arriving at these figures are that the aerodynamic moments vary as the diameter of the ship and the square of the length and of the speed, ignoring for the moment the differences in the aerodynamic characterstics of the two ships. The chief of these differences, so far as stressing of the ship is concerned, lies in the control surfaces, which, as has been mentioned, in R-38 were of new design.

"Model experiments are in accordance with general experience on controls in showing that the R-38 type of rudder and elevator is considerably more powerful than the R-33 type. Further, with the R-33 type of control the rates of increase of moment with control angle fall off rapidly above about 15 degrees to 20 degrees angle of control, whereas with R-38 the moment continues to increase, though slightly less rapidly, up to angles as great as 30 degrees."

After citing some relative figures, the committee says:

"The above table, in which a rough comparison is made of the aero-dynamic bending moments in R-33 and R-38 when the rudders are moved rapidly over in straight flight, shows that the strength required in R-38 was of the order of double that required in R-33. In fact, however, the moment of resistance to bending offered by the two ships was about the same.

"According to Flight Lieutent Wann, who was in command of the ship and standing next to the two men who were operating the rudders and elevators, he was trying the ship on a few short turns to see how she answered her rudders. He had ordered two or three turns with ten degrees of helm and two turns with fifteen degrees. (Note—This is consistent with evidence of various eyewitness.)

"Owing to the length of cable between the control car and rudders, stretch of the control wires and the existence of a tautening spring, the movement of the rudders did not correspond strictly with that shown by the indicator in the control car, and would be greater in the case of overbalance and loss in other cases. There had just been completed 50 degrees of turn with 15 degrees of helm when the accident occurred. He stated that there was no reversal of helm; that is to say, before putting the helm over from port to starboard or the reverse, the helm was put amidships for a brief interval."

STANDARDIZATION IN AERODYNAMICS

By W. MARGOULIS

Former Director of the Eiffel Laboratory, Paris.

WITH reference to the article on "Standardization and Aerodynamics" published by W. Knight in the AERIAL AGE of June 20, 1921, I beg to say that in 1919, while acting as Aerodynamical Expert of the Paris Office of the U. S. National Advisory Committee for Aeronautics, in an article published in "France-Aviation," I made suggestions along the same lines.

These suggestions were warmly taken up by Mr. W. Knight, then Technical Assistant in Europe to the U. S. National Advisory Committe for Aeronautics, and he promptly brought the matter to the attention of the various Aerodynamical Laboratories in Europe and the United States.

The suggestions which we made at that time regarding Comparative Tests were taken up by the National Physical Laboratory in England, and in March, 1920, the N.P.L. sent out a suggestion to other laboratories to make a number of comparative tests on similar models.

According to the plan outlined by the N.P.L. and to other suggestions offered to Mr. Knight by the St. Cyr, The Aachen and Göttingen Laboratories, these tests should have been as follows:

1st—Determination of K_x, K_y and of the centers of thrust on a wing.

2nd—Tests of a complete model of aeroplane comprising the complete determination of forces and moments (it should now be added: "and the influence of the slipstream of the propeller"), and also of the more important stability derivatives.

3rd—Tests of a sphere and a cylinder for determining the degree of turbulence of the airstream.

4th—Tests of a streamline body.

5th—Measurement of the uniformity of the airstream in time.

The tests on the wing and the streamline body should have been made on a single standard model to be tested by all the laboratories successively and on individual models made by each laboratory from the same drawing.

The tests of the model aeroplane should have been made with the same model in all laboratories.

In the summer of 1920 the N.P.L. sent to a number of laboratories a drawing of a streamline body to be used as a first test model, at the same time asking for their ideas on the method of fixing the model to the support.

Since then, however, the project has probably been given up, for nothing more has been heard of the matter, at least by the French laboratories.

We consider, moreover, that if such tests are to give results, they must be both numerous and systematic in order that, as a whole, they shall characterize the airflow in each wind tunnel.

Thus in a paper read October 16th, 1920, at one of the monthly meetings organized in Paris by Mr. Knight and myself for the discussion of Aeronautical problems, I proposed the following tests, and the following recommendations were made:

Tests A.—*Struts*: Fineness Ratio 0: rectangular plate
" " 1: cylinder
" " " 1, 5; 2; 2, 5; 3, 5 and 10: struts proper

Tests B.—*Streamline Bodies*: Fineness Ratio 0: disk
" " 1: sphere
" " 1, 5,; 2; 2, 5; 3; 4 and 6: revolving bodies

For each aspect ratio there would be three models of different dimensions and each model should be tested at all available speeds. We may thus draw up two tables for each laboratory, one for streamline bodies (similar to that given by Prof. Prandtl for the old Göttingen Wind Tunnel) and the other for struts (similar to that which I gave for the large tunnel of the Eiffel Laboratory in the previously quoted article in "France-Aviation").

These tables would form, if I may be permitted the expression, the "finger-prints" of the wind tunnel.

The tests on WINGS should be made on three wings of mathematically defined profile, (the Joukowski profiles, for instance), of different thicknesses and camber. Each wing should be tested with several aspect ratios.

At the same time, the St. Cyr Institute would be requested to test the same models in the open air on its truck; these latter tests would be of great importance, for up to now wind tunnel tests have usually been compared with free flight tests of all full sized aeroplanes, ignoring the intermediate stage, namely, that of free flight tests of models.

This programme may seem rather a long one, but in aerodynamics results can only be obtained by means of a great number of tests.

I also submitted these suggestions to the First International Congress of Aerial Navigation which has just been held in Paris. They were adopted by the Congress and introduced into its resolutions. The following is the text of the Resolutions voted by the Congress:

"General Resolution"

"The First International Congress of Aerial Navigation resolved to form itself into a permanent Congress. It is proposed that the 2nd International Congress of Aerial Navigation be held in London, June 1923. It is recommended that permanent sections be formed in each of the countries represented at the Congress and that they keep in touch with the English Organization Committee with a view to preparing the questions to be studied at the 2nd Congress.

Motions of the Technical Section

"3rd—Study of the measures which may be adopted immediately in the test methods of aerodynamical laboratories in order to make it possible to compare results; in particular to define the geometrical forms and the material realization of a large number of typical models which, tested systematically in well defined conditions, would serve, in some sort, as a characterization of a wind tunnel; also to bring about an agreement that the same collection of such models be tested successively in the various laboratories.

"4th—Unification of the terms and notations employed in the aeronautical publications of the different countries."

The future London Congress seems to be perfectly qualified to solve these questions of Standardization. Let us hope however that it will be really international and that we shall be able to shake hands there with scientists from the North, the South, the East and the West without any discrimination of nationalities.—Let us also hope that the men attending the London Congress shall keep in mind that in the standardization of terms and symbols used in aerodynamics it is immaterial which system is adopted provided that one is adopted by all.

The U. S. National Advisory Committee for Aeronautics is to be complimented for taking the initiative in adopting for wings the same coefficients used by the Göttingen Laboratory; and French laboratories are going to do the same. I doubt however if British Laboratories shall be inclined to accept and to adopt terms and symbols other than their own.

The differences noted between the various laboratories in comparing the experimental results obtained have induced them to come out of their isolation.

In May, 1920, appeared a Memorandum by Miss Lang: "German Aerofoil Tests" (R. and M., No. 695) in which the author compared the results of the N.P.L. closed tunnel with those of the old Göttingen closed Wind Tunnel, obtained on the same wings. The polar curves agree perfectly, with a slight displacement of the lift and resistance curves in function of the incidence.

On the other hand, the Eiffel Laboratory in its researches on the causes of the disagreement between its own results and those obtained by other laboratories, has just found that this disagreement was due to the method of fixing the wings. The following table summarizes the numerical values of the elements of the resultant of the thick and cumbered wing, E. 321, of the Joukowski type:

Incidences	METHOD OF ATTACHMENT			
	On the upper surface of the Wing		On the under surface of the Wing	
	Kx	Ky	Kx	Ky
— 9°	0,00119	0,00254	0,00124	0,00518
— 6°	0,00155	0,0153	0,00138	0,0172
— 3°	0,00239	0,0278	0,00194	0,0298
0°	0,00351	0,0398	0,00279	0,0424
3°	0,00514	0,0519	0,00418	0,0556
6°	0,00694	0,0630	0,00566	0,0675
9°	0,00867	0,0710	0,00732	0,0770
12°	0,0110	0,0763	0,00945	0,0806

Kx and Ky expressed in $K_x/m^2/m$: sec.

We see clearly that the old method of attachment, on the upper surface of the wing, gave much lower polar curves than the new method of attachment on the lower surface of the wing, now exclusively employed in the Eiffel and St. Cyr Laboratories.

Under these conditions the tests of wings in the open tunnel of the Eiffel, St. Cyr and Göttingen (new wind tunnel) laboratories, agree perfectly.

It would thus appear that the results of tests on wings are the same for all laboratories, provided that the type of tunnel is the same, that is, that only tests carried out in open tunnels shall be compared together, or those carried out in closed tunnels. We have thus only to find a means of comparing the two systems. This does not appear to be a very easy matter, for, experiments made at the Institute of St. Cyr, where the experimental chamber can be *proposed* either open or closed, it is shown that the correction proposed by Professor Prandtl does not always accord with the experimental results, more especially in the case of a rather complicated model. Thus, for a complete model of aeroplane the polar curves obtained in an open and a closed tunnel scarcely differed, whilst there was a notable difference in those obtained for single wings.

I consider that this question of corrections to be applied to results of wind tunnel tests is one of the most important for the future Congress, for the laboratories are far from agreeing on the subject. (As a correction depending on the internal structure of the airstream, I would point out that of the N.P.L. due to pressure drop in closed tunnels, and for making corrections due to the ratio between the dimensions of the model and those of the airstream, I would point out first, Prandtl's correction for wings, previously mentioned, and then those of Fage-Collins [R. and M., No. 605] and Wood [R. and M., No. 662] for propellers).

Finally, the laboratories will have to make their results agree with those of test of full size aeroplanes.

We are aware that, as regards this question, there are two opposite camps: that of the optimists and that of the pessimists. The former comprise chiefly those who are working in laboratories and who consider that their tests agree perfectly with those made on full size planes; generally speaking they estimate the error involved not to exceed 10%.

The pessimists, on the other hand, are quite ready to assert that "the results obtained in present day laboratories are of no practical use"; they also say that the laboratories work at rates of airflow which are unstable in general, and very different from the conditions obtaining for aeroplanes in flight, and that, for these two reasons, it is difficult and even useless to attempt to make laboratory results agree.

Finally, we have the aircraft manufacturers who take no interest in such academical discussions and only seek one thing, namely, to be able to forecast the performances of the aeroplane they have designed as accurately as possible and with as little expense as may be. It is they who should offer a prize for *"An International Competition for Obtaining the Best Method for Predicting the Performances of an Aeroplane,"* having special reference to predicting the performaences of an aeroplane, the characteristics of which would be published some months before the free flight tests. By "performances" I mean not only the values of the horizontal and vertical speeds at various altitudes and at various throttles, but also the values of the forces acting on the controls at various regimes.

The tests would be carried on by the Technical Section of Aeronautics of the country of the aircraft manufacturers taking the initiative in this matter.

The Competition should be open to everyone alike: to pessimists as well as optimists, but the latter should be obliged to use the test results of their laboratories on the model aeroplane.

The discussion contributed by Prof. Prandtl, Prof. von Karman and Col. Costanzi to W. Knight's article on "Standardization and Aerodynamics" has thrown some additional light on the subject.

Any further discussion on this matter giving the various points of view shall greatly help in formulating plans for organizing the proposed international Congress and with this end in view the present article was written.

AERIAL TRANSPORT TODAY AND TOMORROW

By Lt. Col. W. A. BRISTOW, M.I.E.E., M.I.A.F., F.R.Ae.S.

IT is a matter of some little difficulty to write in a practical manner of the future of aerial transport owing to the lack of sufficient data upon which arguments can be based or from which conclusions may safely be drawn. This difficulty exists in every department of the subject both on the technical and commercial sides and in consequence our ideas of the future must to some extent be founded on a mixed basis of theory, practice and imagination.

It is impossible for example to give schedules of operating costs that could be taken as a guide to the future as no company in the world has yet run with a complete fleet of aeroplanes and engines such as are considered to-day to be satisfactory for the purpose, neither can we consider that many other important factors are in a satisfactory condition.

It is probably a fair statement that commercial aviation has up to the present been little more than full scale experiment with apparatus largely of a makeshift and temporary character. In spite of these limitations, however, the results have been of an extremely interesting and valuable character and this audience will doubtless agree that the very greatest credit is due to those who have in face of serious difficulties carried ever increasing loads with factors of regularity and safety of a high order.

Chapter I.

Before attempting to deal with the subject in detail it may be as well to examine briefly some of the main outstanding features of the present situation.

In the first place we have to recognize that at present it is not possible to carry on the business without a subsidy in some form or other, and therefore the character, allocation, and working of the subsidy system will have a most important effect on development.

As you are all aware, there has been considerable discussion as to the merits and demerits of the present system, although after hearing much of the criticisms you might be excused for wondering as to whether there were any merits in it at all.

In the first place it has been said that it is a mistake to confine the operations of subsidised services to the London-Paris route and that there are many other routes which are capable of yielding equally good results.

As a result however of close practical acquaintanceship with the working of several of the present air lines I am convinced that a better route could not have been chosen, and that it possesses inherent advantages not to be found elsewhere. In the first place it is about the right length for severity of test, the wide strip of water necessitates a high standard of reliability and the rapidly fluctuating weather conditions along the whole route absolutely compel the rapid development of the two great guardian services of aviation, namely, meteorology and wireless telegraphy and telephony. In addition the two termini and the general operations on the route are controlled by different countries with different ideas and methods and no doubt much of the progress that has been made is due to the mutually instructive effect obtained by such an arrangement. Regarded as an experimental laboratory for the instruction of designers, constructors, and operators, an international route is almost bound to be of far greater value than any purely national one.

From a commercial standpoint also the London-Paris route has very great advantages. The actual journey by land and water with its changes, delays and vexatious examinations, is rendered far more troublesome than its mere length would indicate, and very few people who have experienced the convenience and speed that can be obtained on this route in any reasonably suitable aeroplane will feel inclined to revert to the old means of travel.

Further, the number of potential passengers is enormous and in addition to the subjects of the two countries there are the scores of thousands of travellers and visitors from every country in the world who yearly pass between the two capitals. Many of these gain their first experience of air travel between London and Paris and it is highly probable that they would not have the opportunity of obtaining it elsewhere. Consequently, but for this route being open, we should lose the services of a great number of important and unpaid missionaries, who, if satisfied, will secure for us an ever increasing number of passengers, apart from the value of their propaganda work to the general cause of British aviation abroad.

There are of course hundreds of routes within the Empire that could be opened up to air traffic with advantage, but it is considered that success in these will best be assured by first hammering out the many technical and commercial difficulties on our own doorstep and the Paris-London route for the various reasons given is in the author's opinion specially suitable for this purpose.

The question that next arises is as to whom the subsidy should be given and the decision to increase the number of firms on the London-Paris route from two to three has been somewhat criticised. This audience does not need to be told of the remarkable success of the British Companies in 1921, and they and their supporters can be excused for feeling a little unhappy at the addition to their number bearing in mind the total number of passengers likely to be available next year. Such feeling of uneasiness will, however, in my opinion be completely dissipated if the question is regarded in its wider aspect.

What are the objects in view for which the subsidy is granted? As I see them their order is, firstly, to promote and encourage British aerial transport undertakings in order that they shall be enabled to put up a fight against the very powerful and heavily subsidised competition of the French, and secondly, to help us keep in existence some of the very valuable designing and constructional staffs we had in 1918. But behind all this is the real and vital question of the value of a commercial aviation industry in connection with the defences of the country. Progress in flying generally and especially in connection with the design of machines and engines, depends largely upon actual flying experience and already we see most of the flying all over the world being done by commercial aircraft. Progress in designing military aircraft is therefore to an important extent directly dependent upon the rate of evolution of the commercial side. Further, and this is of vital importance, it is considered that progress can only be continuous if the ranks of aeronautical engineers are constantly replenished with new blood.

Why is it that the design of British ships, turbines, locomotives, internal combustion engines and big electrical plants has progressed with ever increasing vigour during the last few decades and that these products of our shops and yards are to be found in every part of the globe? It is because each of the branches of engineering concerned with the design and manufacture of these things holds out attractive commercial prospects to the brains of the next generation and thus have come into being the various important professions of naval architects, civil, mechanical, electrical and automobile engineers, whose serried ranks wage ceaseless war for efficiency and progress.

It is hardly possible that the profession of aeronautical engineering can be built up on the requirements of military aircraft alone, so that it may well be that the future superiority of our naval and military air fleets will depend mainly upon the growth of commercial aviation, although the actual difference between civil and military aircraft may be as great as that between a "Hood" and a "Mauretania."

The nation is beginning to realise that our position as a naval and military power is undergoing a radical change and that without adequate air power we cannot expect to maintain the Empire. France and Germany both realise this and at the moment the French are actively staking out their claims on every airway of importance on a vast field bounded by Brussels, London, Africa and Constantinople, whilst Germany is concentrating on research and experiment on a most extensive scale. Once the latter is free to establish air fleets for service abroad she will undoubtedly make strenuous efforts to become the greatest air power in Europe, if not in the world. We cannot disguise the fact that technically and geographically Germany is in the strongest possible position for accomplishing this purpose, and we undoubtedly must think of the day when German air lines will radiate from Berlin over the whole of Europe and probably a part of Asia in addition. Already one of the largest firms of aircraft manufacturers in Germany has concluded an agreement with the Russian Government whereby they jointly run a very large factory in Petrograd and halve the profits.

Germany knows and France knows that the future history of Europe will depend to a very considerable extent on the distribution of aerial power and if we are to retain anything like our present position it is absolutely imperative that we develop our commercial air fleets by every means at our disposal. Cutting down our expenditure on the Air Force and Commercial Aviation may render possible some trifling reduction in the income tax, but that will be of little comfort if as a result of the next war the income itself disappears.

This is rather a long digression but it all relates to the question of the number of firms to be subsidised and I think this audience will agree that all the objects in view will be furthered by the addition of suitable firms to the list of operating companies. Even looked at from the narrowest standpoint the possible loss of a few passengers by the existing companies

may be amply compensated for by the additional experience that will be gained.

It is not meant of course that such expansion of numbers can be continued indefinitely or that anybody should receive the subsidy. Much harm can be done and indeed has been done by firms operating without the necessary skill or a knowledge of even the fundamental axioms upon which successful operation is based. I feel sure, however, and I think this audience will agree with me that we need have little fear but that British aviation on the London-Paris services will be worthily represented this year by the firms chosen and that the policy of adding to the number operating is sound and in the best interests of all concerned.

The Air Ministry having provided very largely the ways and means, it now remains with the operating companies to examine carefully the results of past operations with a view to devising means for a more successful solution of the many problems to be solved before commercial aviation can be regarded as a permanent item in our social and industrial life.

Chapter II.

The first item that has to be recognized, in fact it does not wait to be recognized, is the impossibility of at present making anything but a financial loss from the operation of commercial aircraft, although on paper it can be shown with comparative ease that the conveyance of passengers and goods by air can be attended with the happiest financial results even without the assistance of a subsidy. It is so tempting to work out the cost of petrol and oil for four trips per machine per day, deduct it from the gross receipts, calculated upon the assumption that the machines are always full, and out of the handsome balance provide for maintenance and depreciation and a dividend of 200% per annum.

In practice, however, it works out very differently and operating companies are usually to be found pruning-knife in hand attacking every form of expenditure in order, not that the profit may be increased, but that the losses may be reduced. With the aid of the present subsidy schemes in Europe some air transport companies may be showing a profit, but in analyzing the real position it is of course necessary to omit the subsidy items from the accounts, justifiable and essential though they will be for the next few years.

What then must be accomplished in order that a heavy loss can be converted into a profit, and moreover with such a reasonable certainty as will from time to time ensure the supply of such new capital as will allow the industry to be properly maintained and expanded? The whole future of the aircraft industry, the aerial transport companies, our national defense and even the future of the Empire may depend upon our ability to answer this question correctly and it may be as well at once to examine the various means proposed as an amelioration of the present position.

Since the first days of air transport it has been apparent that the very heavy interest and depreciation charges in respect to the fleet can only be met by keeping the machines constantly in the air with paying loads. This year it has been reported that we are to see an aeroplane doing three or four London-Paris trips in a single day. It is not seen, however, that this will solve the problem. If for example two machines are worked on a schedule that keeps them going all day, it will only be possible to maintain the necessary regularity and all the operational advantages that are allied to regularity by maintaining at least one spare machine on each side. A 100% reserve fleet would theoretically always be idle and it would seem therefore to be just as economical to work the four machines on half time. And in any case in several months of the year, weather and lack of light prevent more than one journey per machine per day, or two at the most.

Designers and constructors of aircraft and aircraft engines approach the subject from another standpoint and are bending their energies to effect improvements which have for their object an increase of the paying load in relation to the fuel consumed and the cost of maintenance and operation. Such work is of the utmost importance and progress will be vitally affected by the degree of success that is achieved in these directions.

It is clearly impossible however to wipe out all the loss by improvements in thermal and aerodynamic efficiencies. Engines already closely approach the limit of thermal efficiency and he would be a bold designer who would guarantee actually to produce aeroplanes even 15 per cent more efficient than the best of those existing today. I see no imediate hope therefore that the work of the aircraft designer will enable the loss to be turned into a profit. Of course improvements in equipment, organization and methods of operation are all most valuable and must on no account be neglected but the sum of them all will not be sufficient to turn the scale.

If civil aviation therefore is to have any future, what *is* required?—In the author's opinion there is only one answer—Passengers and yet more passengers. Given even a moderate percentage of the travelling public, civil aviation it is considered could be made to pay its own way within the next five or six years.

It is true that last year showed a welcome increase and that this year may see a still further advance in the total number of passengers carried, but as the excess will be shared by some seven or eight companies it is extremely doubtful if the net increase per company will be anything material. Furthermore if the weather is not so good as that of last year the total number carried may be even less.

The regular and safe transport of passengers by air demands a highly skilled staff, but in addition to the overhaul and maintenance staff which will have to be increased as the number of passengers increases, although not in the same proportion, there are those engaged in the management and operation of the commercial side of the business and also those responsible for superintending the actual working of the fleet.

What other class of transport company could afford to keep a staff of such proportions for less than 50 passengers per week taken as an average over a whole year? In some undertakings the total number of persons employed in the working of the fleet is greater than the weekly average of passengers carried. No other form of transport could live for long under such conditions however efficient their vechiles or methods.

This small number of passengers, in addition to raising inordinately the percentage of overhead and other charges per passenger, actually hampers the efficient working of the fleet in several important respects. For example, the necessary smallness of the fleet limits the number of departures that can be made during any one day; and the consequent inelasticity as to times of departure and space available, renders the fleet incapable of adequately dealing with traffic out of the normal.

It is very difficult at this early stage to form any exact opinion as to the minimum number of passengers that should be carried per week. Incidentally the aerial week will probably have to consist of seven days as in every other transport undertaking. To cease work on Sunday, in addition to inconveniencing the public and delaying the expansion of the business, causes a loss of 14½% per year on the working time, thus further raising the cost per flying hour.

On the basis of a week of seven days the author has formed the opinion that the minimum number of passengers necessary weekly for the profitable operation of any one company is not less than about five hundred and those must be carried in the most efficient machines operated by an exceedingly skilled and highly organized personnel. There are undoubtedly many who will consider this figure excessive, but probably few will dispute the statement that the present numbers must be increased several times over before the business of aerial transport can be carried on at a profit without the assistance of subsidies.

Chapter III.

By what means then are we to attract the far greater number of passengers required? It cannot be said at present that there is any real concerted effort being made by the companies to attract the public. Much of the advertising and propaganda is aimed at securing as large a share as possible of the numbers already travelling and but little if any to encourage the general use of the airway. Before we can answer the question as to how the increase is to be obtained it will be necessary to try and form some idea as to the main reasons that keep the public back.

It is considered that the chief reason lies almost wholly in the fact that insufficient attention has been concentrated upon the problem of making flying really safe, and secondly we have no made it look and feel as safe as it is. I am not now speaking of any one company or even of any one country, but as a result of a close examination of the commercial air fleets of the world as a whole and after talking with hundreds of passengers and timid enquirers after knowledge, I am forced to the conclusion that the question of safety is the most important and the one most urgently calling for treatment if even a moderate proportion of the travelling public is to be converted.

We are rather apt to think that the public know little of the factors determining safety in flight and that to them all aeroplanes are very much alike. Experience has shown this idea to be completely erroneous. The author has heard many conversations that show the contrary to be the case and on more than one occasion has witnessed passengers refusing to travel on a machine which they did not consider either safe or sufficiently comfortable.

Factors Affecting Safety:

Pilots

The experience of last year has revealed several points that require serious attention even although the number of fatalities

and injuries was low and in the case of the British Cross-Channel Services was actually nil. As, however, all companies have to suffer if anything impairs the confidence of the public, it is necessary to survey the European services generally and the operations of some have undoubtedly given cause for considerable misgiving. Probably the most serious cause of accidents has been lack of skill and judgment on the part of the pilots although it is necessary at once to except British pilots from this generalisation. Our own pilots have on the contrary proved themselves over and over again to be exceptionally skilled and resourceful pilots and navigators and it is impossible to praise their work too highly. I may be stirring up a hornets nest but I am strongly of opinion that British Commercial Air Pilots as a body are more highly skilled than any other body of pilots in the world, be they naval, military, or civilian.

On the Continent and in America, however, there is considerable room for improvement not only in the actual flying methods but in the qualifications deemed necessary by the operating companies for pilots that are to be entrusted with passengers to be taken on long and difficult routes. It seems almost incredible but it is a fact that pilots are sent off with passengers on long routes over which they have never flown before to land on aerodromes they have never seen. It is considered by many that the question of the training of suitable pilots is one calling for the most serious attention by all those concerned with the control and operation of commercial aerial transport.

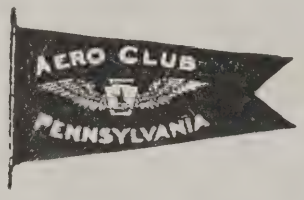
Aeroplanes.

It is of course highly desirable to design aeroplanes capable of carrying the maximum possible useful load for a given horsepower which will be capable of being operated at a high speed with a minimum consumption of petrol and oil. As many in this audience well know, however, it is impossible to attain these ideals to their fullest extent and at the same time preserve the same factor of general safety, and if passengers because it is not sufficiently safe will not come forward in sufficient numbers to make the business pay, then the possession

(*Continued on page* 627)

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut St., Philadelphia
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
HENRY F. BAMBERGER, *2nd Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*



DIRECTORS

CHARLES L. HOWER
GEORGE S. IRELAND
WALLACE KELLETT
FRANK A. L. LEAHY
ROY G. MILLER
D. J. SPENCE, JR.
A. STANLEY TRUSCOTT

The attention of the members of the Club is again called to the many interesting and instructive lectures which they have the privilege of attending, through the courtesy of the Franklin Institute. These lectures are in most instances free to the public and all members of the Club have a standing invitation to attend same.

On the evening of February 15th, Mr. L. J. Briggs, M. S., Ph.D. Chief, Engineering Physics Division, Bureau of Standards, gave a lecture treating of wind tunnels for obtaining air-streams of known velocity; aero-dynamical balances for measuring air forces on a model; the air resistances of bodies of different forms; air-foils and the measurement of the resistance of projectiles. The lecture was well illustrated by lantern slides.

On March 2nd, Colonel E. Lester Jones, A.M., Commissioner, International Boundary United States-Canada, Director, U. S. Coast and Geodetic Survey, will lecture before the Institute on "Surveying from the Air." A brief description will be given of the standard surveying methods of the Coast and Geodetic Survey and their relation to aerial surveying before and during the world war. Experiments of the Coast and Geodetic Survey following the war. Photography of under-water features in co-operation with the Naval Air Service. This lecture is also listed to be fully illustrated by lantern slides.

It has been reported that the City Commissioners of Atlantic City has instructed the City Solicitor to notify the Curtiss Eastern Aeroplane Company with headquarters in Philadelphia that the privilege of using the beach front for the operation of planes will be terminated. This action may result in the transfer of the station to Ventnor City, Margate or Longport. As many members of the Club fly each year from the Inlet Station of the Curtiss Company it is hoped that the report is unfounded and that the familiar sight enjoyed by all visitors to the shore will be seen this coming season as usual.

The monthly stated meeting of the Club was held, evening of February 21st. It had without doubt the largest number of members in attendance which the Club has had for many years. The election of a Board of Directors for the year 1922 resulted in the following members being unanimously elected: Messrs. Chas. L. Hower, George S. Ireland, W. W. Kellett, F. A. H. Leahy, R. G. Miller, D. J. Spence, Jr., and A. S. Truscott.

The Club, through its president, Joseph A. Steinmetz, sent a telegram to the Chief of the Army Air Service extending its sympathy and expressing its regrets over the disaster to the dirigible Roma.

The Club was in session at the Engineers' Club when details of the tragedy were received. The paper then under discussion was in the form of an illustrated lecture by Arthur Halsted, Associate Electrical Engineer, Bureau of Standards, Department of Commerce, Washington, D.C. The subject of the lecture was "Prevention of Accidents in Aviation." "It was a most tragic moment when in the midst of the discussion we heard of this disaster," said Mr. Steinmetz. "This accident will delay the development of the dirigible type of craft for some time I fear. The enthusiasm for lighter than air craft is likely to be dampened after the recent disasters to that type of craft. I look for the development to turn more attention on the heavier than air craft."

Mr. Halsted, the lecturer, stated that he had seen the Roma in flight in Italy in 1918 and that a number of Italian officers had told him that the craft had exhibited many peculiarities in her control system from time to time, and that the great ship was never taken out for flight by the Italian authorities except on calm days. Mr. Halstead further stated that he believed the United States officials knew this when the purchase of the ship was made.

Mr. Halsted's lecture was one of the most entertaining the members of the Club have ever had the pleasure of attending. The motion pictures were of the clearest and featured many parachute "take offs" from planes at the various flying fields. Each film was greeted with a round of applause and the lecturer was given a rising vote of thanks at the conclusion of the talk.

The members of the Club will please note that the Philadelphia Chamber of Commerce have just appointed an Aviation Committee for the current year and that acceptances of the appointment have been received from the following: Messrs. S. B. Eckert, Chairman; Chas. J. Biddle, Albert M. Cohen, Robert Glendinning, Stephen H. Noyes, H. N. Taylor and Joseph A. Steinmetz.

It is intended that this group shall be invited regularly to all the meetings of the Club so a liaison may be established between all control groups on aviation matters.

It is announced to the flying group of the Club that beginning with January 15th, 1922, the Weather Bureau at Washington has been telegraphing flying forecasts to the office of the Philadelphia Weather Bureau, daily. The forecasts are received about 11 o'clock A.M. and hereafter will be available to anyone calling up the office. Bell phone, Walnut 9432; Keystone phone, Race 2713. This information is given by George S. Bliss, Meteorologist, Philadelphia, Pa.

The interesting announcement was made to the members that within the next few weeks a regular air express and passenger air line would be put in operation between New York, Atlantic City, Philadelphia and Washington.

The planes will be of the Fokker passenger type and the proposed rate of fare of thirty-five dollars for a round trip between Philadelphia and Washington is a most attractive one. Major Schauffler one of the representatives of the company stated that even this low rate of fare will be reduced as soon as the number of passengers carried would warrant same.

The Contest Committee of the Club is making every effort to hold an aeroplane meet in Philadelphia in the early spring. Three silver trophy cups and a bronze tablet as well as cash prizes will be awarded.

W. H. SHEAHAN.
First Vice-President.

NAVAL and MILITARY AERONAUTICS

Roosevelt Argues for Carriers

Washington.—Aeroplane carriers are vitally necessary to the navy, since aeroplanes themselves have shown they are essential to the work of the fleet, Assistant Secretary Roosevelt told the House Naval Committee, February 20.

Mr. Roosevelt said that by converting two battle cruisers into carriers a saving of $18,000,000 could be effected.

"The department strongly recommends the two battle cruisers now building and on which $40,000,000 each has been expended should be converted into aeroplane carriers as a vital part of the naval establishment," Mr. Roosevelt said. "Our experts have figured that it would cost $13,000,000 each to complete them, but if we discard them it will cost $22,000,000 each to build anew."

Hitch in Zeppelin Deal

Washington — The Navy Department has notified the State Department that it does not wish the German Zeppelin now being constructed for the United States by Germany under the reparations clause of the Versailles treaty unless it comes to America without cost.

The question has arisen as to whether the amount of money allotted for this purpose by the Allies under the reparations agreement to the United States was sufficient to complete the Zeppelin.

At the Army Air Service it was said that if the navy refused to take the Zeppelin under additional cost that would not preclude the army from taking her.

Spad Outstrips the SE-5

The First Pursuit Group at Ellington Field reports that two reconstructed Spads have been completed and tested satisfactorily, with a speed considerably in excess of the SE-5. The reconstruction of a sufficient number of these Spads will allow the Pursuit Group to carry on training successfully pending the release of the MB-3's. The reconstructed Spad referred to is the Spad XIII, in which the 220 Geared Hispano Suiza Engine has been replaced by the 180 h.p. Wright.

Progress in Training Student Officers

New classes in advance training for student officers and cadets are under way at Ellington and Kelly Fields, there being ten pursuit and seven bombardment students enrolled. Aeroplane Pilot rating has been received by all members of previous classes and many new wings adorn the breasts of recent graduate in recognition of proven ability.

Triplane Assigned to 90th Squadron

The GAX twin liberty armoured triplane, which some pilots interpret as guns, armour and X the same as in algebra, has been assigned to the 90th Squadron (Attack) and is being flown by pilots of the 3rd Group (Attack). The performance of this attack plane during aerodrome hops has been satisfactory. A speed of approximately 106 miles per hour has been attained, and the maneuver-ability is all that could be expected for a plane of such great weight. The limited gasoline supply (two hours) together with the extensive ground required for landing and taking off, especially in high altitudes, is a serious factor to be considered in connection with the successful operation of this plane from border stations.

Flight Surgeons Graduate at Mitchel Field

The School for Flight Surgeons at the Medical Research Laboratory, Mitchel Field, completed the first session of the year on January 21, 1922. Graduating exercises were held at the school at 11:00 a.m. on that day. Dr. Edward C. Schneider, director of the department of Physiology, and one of the pioneer workers in aviation medicine, addressed the class and guests on the history of aviation medicine. Major W. R. Weaver, Commanding Officer of Mitchel Field, also delivered an address and presented the class with their certificates. Major L. H. Bauer, the Commandant of the School, spoke briefly, and then presented the other speakers. The graduates were: Captain Lyle C. White, honor graduate, Captain Luther H. Kice, Captain Shores E. Clinard, Captain Bernard L. Jarman and Major Cadmus J. Baker. Following the exercises the Commandant and the Academic Board gave a luncheon at the Officers' Club for the graduating class and guests.

The Academic Board consists of Major L. H. Bauer, Major Lloyd E. Tefft, Major R. F. Longacre, Captain John B. Powers, Dr. Edward C. Schneider, Miss Barbara V. Deyo and Miss Dorothy Truesdale.

Recruiting Reserves On Mexican Border

Assignment of available reserve Air Service officers has been made in the 90th Division (Organized Reserves) El Paso, Texas. Reserve pilots in this vicinity are preparing to stimulate interest in aviation by recruiting former Air Service mechanics as a nucleus for a live organization to be kept ready for action.

Air Cadet Killed at Fort Sill

Lawton, Okla.—Harvey J. Wright, twenty-three, of St. Louis, cadet pilot at Post Field, Fort Sill, was fatally injured, and Archie S. Yandell, twenty-two, cadet in the observation school, is not expected to live, as a result of injuries received when they attempted a landing in their aeroplane near the post late February 14.

Personal Par

Major Orde Lees, British baloonist and Artic explorer and well known in America, has just completed a trip to the summit of Fujiyama, the celebrated mountain in Southeastern Japan. It is said he is the first European to have reached the top of the mountain in winter, which is 12,365 feet above sea level.

Japanese Officers Express Appreciation

The recent visit to Mitchel Field of Japanese officers of the Imperial Japanese Army brought about the following letter of appreciation from the Imperial Japanese Embassy at Washington: "Relative to the visit on or about the 9th instant (January 9th) of Colonel Y. Aramski, Colonel M. Fuke, Major T. Watanabe and Major N. Tanifuji to the Mitchel Flying Field at Mineola, L. I., I have the pleasure of expressing my high appreciation of the favors and facilities bestowed upon them by the Commandant, Major Weaver, and his able Lieutenant, Lieut. C. E. Crumrine, by which my officers were enabled to retain very pleasant recollections of an instructive and enjoyable visit."

Water Softening Plant Erected at Carlstrom Field

A water softening plant was received and erected at Carlstrom Field, near the oil reclamation plant, and water therefrom is piped to three different points on the line. The necessity for this plant was felt on account of the nature of the water available at this station for use in aeroplane radiators. Considerable trouble with radiators has been experienced, due to the corrosive effects of the water.

Planes Capture Rum-Running Ship

Miami, Fla.—The British schooner Annabelle was seized February 19 about forty miles south of Miami with a cargo of 11,500 cases of whisky aboard by aeroplanes of the prohibition squadron operating out of Miami and adjacent coastal towns. The crew offered no resistance when the aeroplanes, with their machine guns pointing at the schooner from all directions, swooped down on the vessel.

Eleven planes, painted a battleship gray, gradually made their way down the coast last week, one of them, under the command of Captain Rogers, stopping at Miami. Some of the others stopped at St. Augustine, Jacksonville, Charleston and other points.

Advance information was furnished by scouts aboard sub-chasers which got the location of the Annabelle and several of the planes guarded near Jewfish yesterday and at a signal flew simultaneously over the alleged whisky carrier.

A Captain Johnson, who brought the report here, stated that the prohibition squadron was equipped with a wave code which no other wireless apparatus could interpret, and this is used exclusively in the sending and receiving of official messages. In the stern of each plane is a machine gun capable of firing 400 shots a minute, manned by an expert gunner.

Flying Weather Forecast

Arrangements have been made for the inclusion by the Weather Bureau of a *flying weather forecast* for zones 1 to 5, inclusive, for the period midnight to noon of the following day, in the *weather broadcast* from the naval radio station at Arlington, at 10 p. m. daily, commencing January 16, 1922.

The form of this forecast and the areas covered will be the same as that included in the morning *weather broadcast* from Arlington.

FOREIGN NEWS

British Aeronautics

Commercial pilots will soon be furnished with up-to-the-minute weather reports and will thus have a knowledge of atmospheric conditions ahead of them. Wind direction and speed, visibility and cloud height are all to be faithfully reported, the information to be laid out in big white letters on aerodromes so that pilots of air expresses as well as the passengers can see at a glance what the weather is along the airways.

A correspondent of the *London Evening News* states that the very latest notion for the easy handling of commercial aircraft is to have the nosepiece, which includes the engine, all made in one piece, so that it can be taken off in a few minutes and another put on. Thus, if trouble in the engine develops, it will not detain the whole machine, as by undoing four bolts the troublesome engine can be removed and a new one put on immediately. The idea is being used on all the De-Haviland aircraft which are being prepared for next year's air lines.

The report of the Director of Medical Services, Col. M. H. G. Fell, Royal Air Force, for 1920 gives the number of flying accidents during the year as 71, of which number 39 occurred in the United Kingdom and 32 overseas, resulting in 14 deaths at home and 15 overseas. There was only one accident among the cadets, which was not of a serious nature, and a single death occurred amongst the N. C. O. observers.

Paris-Constantinople Air Route

Two French airmen, MM. Deulin and de Marmier, have brilliantly mapped out the Paris-Constantinople air route by their initial flight out and back in 35 hours of actual flying. After leaving Paris they made long halts at Strasbourg, Prague, Budapest, Belgrade and Bukarest. The distance of 1,770 miles from Paris to Constantinople was covered in 17 hours of effective flight. The return journey from Constantinople to Paris was made in 18 hours of actual flight.

Copenhagen-London Route

A London newspaper states that the Danish Air Traffic Co. has now completed its arrangements, in connection with a Dutch concern, for regular air traffic between Copenhagen and London, via Rotterdam. The service will open on May 1, subject to a State subvention being received towards the 500,000 kronen which it is estimated will be the cost of the service for one year.

Swiss Civil Co-Operation

The Swiss Government has decided to increase the financial help that it is giving to civil aviation, and is prepared to assist in the establishment next year of a Swiss air mail to connect with international services. In the budget for 1922 the program for subsidizing civil aviation contemplates the increase of the military grant for each service pilot from 200 francs to 400 francs, also provision for grants in aid to enable civil aviation concerns to buy modern transport machines.

Syrian Line

A new air service has been instituted in Syria between Latakia and Homs. Two journeys each way are, according to the Paris *Temps*, made per week, as on the similiar services between Aleppo and Deir-Zor, Aleppo and Aintab, and Aleppo and Alexandretta. Services are also to be opened between Damascus and Palmyra and Damascus and Soweida (Hauran). A number of packages were carried on the Levant services, and in November, 31 wounded or sick were evacuated by aeroplane without accident.

Italian Invents Airless Airship

London—An airless airship dirigible capable of a speed of 215 miles an hour at high air levels is to be constructed in Italy from the plans of Signor Vaugean, leading Italian balloon expert. Signor Vaugean's ship is to be a vacuum, with three ordinary envelopes, one inside the other. From a perfect vacuum in the inner envelope air pressure would be regulated in the intermediate and outer envelopes so as to prevent collapse of the airship through the enormous pressure of the outer air.

Italian experts are enthusiastic over the invention. It is expected to revolutionize dirigible flying.

Instead of using the present gas-filled container, Signor Vaugean has created plans, the basis of which is the inner vacuum envelope—lighter, naturally, than the lightest gas, from which air would be expelled by means of vacuum pumps. Experiments with vacuum airships have failed because of the enormous pressure of the outer atmosphere, amounting with a perfect vacuum to as much as fifteen pounds to the square inch on the outside of the ship.

Signor Vaugean believes he has overcome this by building a ship in three sections, one inside the other. The space between the outside of the ship and the first interior hull would be partly emptied of air. Still more would be pumped from the intermediate envelope. The center bag would be as nearly a perfect vacuum as it would be possible to obtain.

In this way the pressure of the outside atmosphere would be distributed over three surfaces. It would be reduced to less than five pounds per square inch on any portion of the ship.

Signor Vaugean's ship will be equipped with four three hundred horse-power engines of the type invented by Prof. Garuffia. These would burn heavy oil instead of petrol, thereby, with the absence of inflammable hydrogen usually used to inflate airships, eliminating to a great extent the danger of fire.

The engines will serve a double purpose. Besides propelling the ship, they will work the pumps by which air will be expelled from the envelope, so that the vacuum can be increased or diminished at will in order to make the ship rise or fall.

It is claimed that owing to the novel construction of the hull and to the ship's ability to rise to greater heights than the ordinary airship, reaching levels where the air is more rarefied and therefore offers less resistance, speeds as great as 215 miles an hour will be possible—fifteen hours between London and New York.

Meeting of the Committee of the Fédération Aéronautique Internationale, Paris, January 9, 1922.

Countries represented: France, Great Britain, Holland, Italy, Spain, Switzerland, United States. Lieut-Col. O'Gorman presented a report of the meeting to the Committee of the F.A.I. held in Paris on January 9, 1922.

The principal items of the report were:

It was decided to adhere to the same regulations as last year for the Schneider race. The date was fixed for the last fortnight in August, and the contest would be held at Naples.

It was decided to hold the Gordon Bennett balloon race at Geneva on Sunday, August 6, 1922.

The proposal of the Royal Aero Club to introduce the Tryptique for Sporting and Touring machines entering foreign countries was considered. The Aero Club de France has already approached the French Customs Authorities on the subject, and reported that the Director of Customs in France had expressed willingness to accept the guarantee of the Aero Club de France in relation to the Customs. The draft form of Tryptique prepared by the Aero Club de France was to be sent to the Clubs of the Federation for their approval.

The Royal Aero Club of England asked for the introduction of Slow Speed Tests in International Speed Races. This was agreed to, and the Clubs were requested to send in suggestions for the carrying out of these tests for the consideration of the F.A.I. at its meeting in Rome.

The other subjects under consideration were International Maps, Permanent Commissions, and Records.

World's Aviation Records, Up to December 31, 1921

Issued by the Royal Aero Club as representing the British Empire on the Fédération Aéronautique Internationale.

DURATION

AMERICA.—*Pilots.*—E. Stinson and L. Bertaud. *Date.*—December 29 and 30, 1921. *Machine.*—"J.L.6" Monoplane. *Motor.*—B. M. E. 185 h.p.

Duration of flight, 26 hrs. 19 mins. 35 sec.

DISTANCE

Returning to Point of Departure Without Alighting

FRANCE. *Pilots.*—Lucien Boussoutrot and Jean Bernard. *Date.*—June 3 and 4, 1920. *Machine.*—Farman Goliath. *Motor.*—Two Salmson 260 h.p.

1,915.2 kiloms (1,190 miles).

ALTITUDE

AMERICA.—*Pilot.*—Major Rudolph W. Schroeder. *Date.*—February 27th, 1920. *Machine.*—Lepere. *Motor.*—Liberty 4400 h.p.

10,093 metres (33,114 ft.).

SPEED OVER A DISTANCE OF 100 KILOMS.

ITALY.—*Pilot*—Brack Papa. *Date.*—October 1, 1921.—*Machine.*—Fiat.—*Motor.*—Fiat 700 h.p. *Time.*—20 mins. 5⅗ secs.

298.66kiloms per hour (185.58 m. p. h.).

SPEED OVER A DISTANCE OF 200 KILOMS.

FRANCE.—*Pilot.*—Georges Kirsch. *Date.*—October 1, 1921. *Machine.*—Nieuport-Delage. *Motor.*—Hispano-Suiza 300 h.p. Time.—42 min. 39⅘ secs.

281.272 kiloms. per hour (174.77 m.h.p.).

SPEED OVER A DISTANCE OF 1,000 KILOMS.

FRANCE.—*Pilot.*—Lucien Boussoutrot and Jean Bernard. *Date.*—June 3 and 4, 1920. *Machine.*—Farman Goliath. *Motor.*—Two Salmson 260 h.p. *Time.*—10 hrs. 19 mins. 46 secs.

96.81 kiloms. per hour (60.155 m. p. h.).

SPEED OVER A DISTANCE OF 1,500 KILOMS.

FRANCE.—*Pilot.*—Lucien Boussoutrot and Jean Bernard. *Date.*—June 3 and 4, 1920. *Machine.*—Farman Goliath. *Motor.*—Two Salmson 260 h. p. *Time.*—16 hrs. 42 mins. 8 secs.

96.81 kiloms. per hour (60.155 m.p.h.).

SPEED OVER A DISTANCE OF 1,500 KILOMS.

FRANCE.—*Pilot.*—Lucien Boussoutrot and Jean Bernard. *Date.*—June 3 and 4, 1920. *Machine.*—Farman Goliath. *Motor.*—Two Salmson 260 h. p. *Time.*—16 hrs. 42 mins. 8 secs.

89.808 kiloms. per hour (55.804 m.p.h.).

GREATEST SPEED OVER A DISTANCE OF ONE KILOM.

FRANCE.—*Pilot.*—Sadi Lecointe. *Date.*—September 26, 1921. *Machine.*—Nieuport-Delage. *Motor.*—Hispano-Suiza 300 h.p.

330.375 kiloms. per hour (205.223 m. p. h.).

USEFUL LOAD TRANSPORTED (ALTITUDE)

FRANCE.—*Pilot.*—Thierry. *Date.*—October 10, 1920. *Machine.*—Breguet.

Useful load of 250 kilogs. (551 lbs.).

Altitude 6,965 metres (22,851 ft.).

USEFUL LOAD TRANSPORTED (ALTITUDE)

ENGLAND.—*Pilot.*—Capt. C. T. R. Hill. *Date.*—May 4, 1920. *Machine.*—Handley Page. *Motor.*—Two Napier "Lion" 450 h. p.

Useful load, 1,674 kilogs. (3,691 lbs.).

Altitude, 4,267 metres (13,999 ft.).

USEFUL LOAD TRANSPORTED (DURATION)

ENGLAND.—*Pilot.*—Capt. C. T. R. Hill. *Date.*—May 4, 1920. *Machine.*—Handley Page. *Motor.*—Two Napier "Lion" 450 h.p.

Useful load, 1,674 kilogs. (3,691 lbs.).

Duration, 1 hr. 20 mins.

Safe Flying in Fog

Experiments are being conducted in England to combat one of the airmen's worst enemies—the fog—and, according to the London *Evening News*, the very latest idea for flying through fog is a wireless compass which can be set to any destination. The pilot will grope his way down to the aerodrome by an arrangement of intersecting searchlight beams, the height of the point of intersection of the beams above the aerodrome being known to the pilot. This is the idea of Sir Arthur Whitten Brown, navigator to the late Sir John Alcock on his transatlantic flight, who states that the wireless compass will be worked by directional wireless, the compass tuning in with a ground wireless station. Thus, if a pilot wants to fly from London to Paris, he sets the compass in tune with the Le Bourget (Paris) wireless station, and then he steers by this compass through the fog—or above it when possible—and he will find himself in due course over the Paris terminal.

In practically all fogs the aeroplane pilot finds clear weather before 1,000 ft. up, and experiments have recently been conducted successfully at Croydon with an instrument for ascertaining the height of the fog. This instrument is sent up on a small balloon, and on it is a brass ring. As long as the instrument is in the damp fog the ring is held in position, but as soon as it gets above the fog into clear, dry air, the catch holding it contracts and the ring slides down the string. The amount of string paid out is measured, and this gives the height of the fog. It is expected that by next year fog will not in any way interrupt the air liners.



Points to Be Considered in Choosing the Wing Curve for a Soaring Plane

When one stops to consider the limited number of wing curves, of which the characteristics were known with a fair amount of certainty, existing in the earlier days of power flight, the advantage to the soaring-plane builders of today is apparent. It is quite true that the aeroplane wing curves available at this stage of the science will soon be replaced by many which will be greatly more suitable. These changes, however, will not come at once, nor will the improvements be realized by many, so gradually will they be revealed. Intelligent application to the soaring flight problem, of our data on aeroplane wing curves will go a long way toward the desired goal.

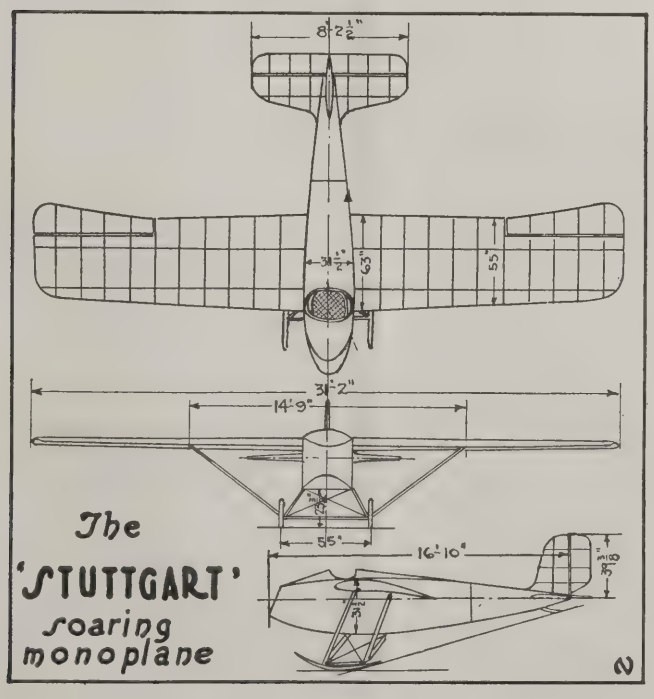
So many wing curves have been tested and their characteristics so carefully recorded that the selection of a suitable curve can be made with a good knowledge of its structural possibilities as well as its behavior in the air. If the builder has a reasonably definite idea of the general design he favors, the choice of a curve suitable for that design need not be haphazard, but can be chosen with deliberation.

First of all, the builder should know whether he will dispose the wing surfaces in monoplane or biplane form, etc. Monoplane surfaces exert more lift than biplanes, and for this reason the monoplane appears as a better choice. The monoplane has its structural drawbacks, however, and the designer must consider for himself whether these disadvantages are offset by the strength obtainable in planes arranged in biplane form.

The monoplane may be externally braced, it may have a cantilever structure or it may be entirely braced internally. Wing curves lend themselves differently to these types of structure and they determine the form of structure required for their proper use. Obviously it is necessary to employ a deep wing section for an internally braced monoplane—this narrows our choice to one of the thick wing sections. The cantilever and externally braced types need not be so thick, and one of the medium-thick sections is the natural choice.

Biplanes and other forms of structure with superimposed wings, can advantageously use the thin, high-lift sections. Many of these thinner sections are weak structurally and must be braced and trussed at frequent intervals; and of course this adds resistance to forward motion. No wing should be chosen that cannot advantageously be built light; often some of the thinner aerofoils are required to be heavy out of all proportions to their actual efficiency. Whether biplane or monoplane, the prime consideration is to decide upon a profile which can be built as light as consistently possible.

By consulting the graph charts accompanying most of the tested aerofoils, we can find the amount of lift in relation to the drag, the lift and drag coefficients, and the travel of the center of pressure, for various angles of incidence. Now we wish to obtain a wing with the highest lift coefficient, but we find that while some high lift wings are available for our needs, the center of pressure travels extensively and perhaps at some angles it moves quickly and erratically. This is bad, if the movement occurs in any of the angles of setting required for the machine under consideration. Choose a curve with a smooth, even center-of-pressure travel, even though the lift coefficient is moderate.



The Stuttgart Soaring Monoplane

By H. J. Nordman

Member of Long Island Flight Association

SOARING flight in Germany has already reached the stage where soaring plane students are taught to fly on a specially constructed plane. In the Stuttgart Soaring Monoplane the designers sought to develop a machine to be used primarily as a school machine.

In spite of the fact that this machine was intended only as a school machine it showed up remarkably well in the Rhon Soaring Contest. Of particular merit were its durable qualities. On one occasion a sudden wind puff lifted the machine into the air and dashed it on its back without the slightest injury to any part. For transport purposes the entire machine may be taken down and compactly arranged for shipment.

This machine was designed and built by members of the Technical Flight Society of Stuttgart. The four most prominent features considered in its design were:

The carefully streamlined fuselage, the simply attached lifting surfaces, selection of wing profile, and with the head resistance kept as low as possible, a very aerodynamically efficient machine was produced. No effort was made toward automatic stability in order that the student should be given every opportunity to develop and adapt himself to unforeseen conditions which arise in actual flight.

The longerons and struts are of white pine. Fuselage struts are rigidly braced to the longerons by 3 millimeter walnut veneer gussets; these gussets are inserted in grooves in the struts and longerons and glued into place. The horizontal stabilizer and fin are faired into the streamlined fuselage. The stabilizer has two main beams. Rigidly braced members are placed at the point of the fuselage where the wings are attached. The fuselage nose longerons consist of two parabolic formed ash members. The nose of the machine is planked on the bottom with veneer and covered on top with cloth.

The pilot is seated very low in the fuselage, slightly forward of the front wing beam. Stick control and rudder bar are used.

The four strong skid braces evenly distribute the landing shocks to the main members. The two main ash skids are so arranged that the spring in landing is taken up by a knuckle joint which moves aft. The rounded underside of the skid prevents any tendency to get into a rut. Skids are braced with 3 mm steel wire. Struts are all hollow, their ends inserted in metal sockets. A steel wire is passed along the front edge of struts, connecting the two sockets.

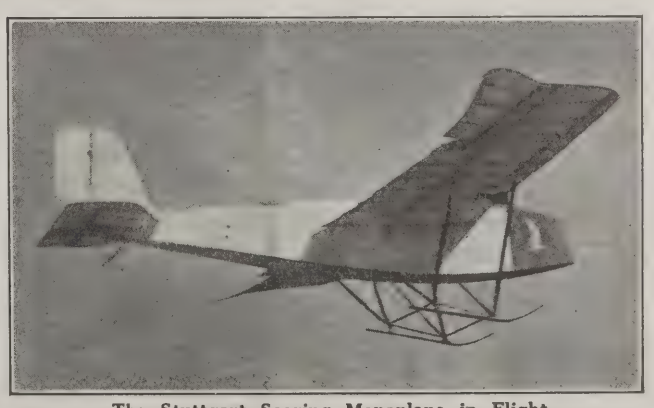
The tail skid is hinged and rubber shock absorbing cord is used. The rudder is made of light steel tubing.

The winges are trapezoidal in outline and contain 140 sq. ft. of surface. The main beams are of box girder veener construction. Front and rear beams have the same width, though not the same depth. Both beams are tapered.

The wing profile used was taken from the Göttingen Aerofoils Report, Profile No. 426. This section has a very high L/D ratio.

The wings are attached to the fuselage and are braced by struts running to the landing skids. Each beam is fastened to the fueslage with one bolt. The beam ends are reinforced with sheet duralumin.

Brace struts sockets are bolted and riveted to the struts. One end of each brace strut is threaded and receives a forked end for the purpose of changing the dihedral or angle of incidence setting.



The Stuttgart Soaring Monoplane in Flight



The Ancient Aeronaut

It is an ancient aeronaut,
  And he sitteth on a stone.
With vacant stare he tears his hair
  And groans a ghastly groan.

"What ails thee, ancient aeronaut.
  And why thy plaint so drear?"
The aeronaut in gloomy thought
  Now seemeth not to hear.

"What ails thee, ancient aeronaut.
  And why thy fearsome eye?"
"Because," said he, "I dread to see
  These K-dets seek to fly.

"Because," quoth he, "as you can see,
  Their work is passing coarse.
Now I've flown here for many a year—"
  His voice was strangely hoarse.

"Yes, I've flown here for many a year,
  And a tale I have to tell.
My first K-det is flying yet;
  But his sole flight I mind well

"My first K-det, his name was Pett;
  And his head was solid marble.
From day to day whate'er I'd say
  He'd never fail to garble.

"Each morn, each night, I'd set him right.
  Methought he'd never fly."
The aeronaut sat lost in thought;
  Then wiped his glistening eye.

He shook his head, and softly said:
  "My word! That boy was thick!
Now more than once, the silly dunce,
  He froze upon the stick.

"I seized my cane. With might and main
  I smote him on the pan.
I broke his hold, for I knocked him cold—"
  I saw how the hot tears ran.

And now I saw a J.N.4
  Make a landing twelve feet high.
"My ship, I wot," quoth the aeronaut;
  And he heaved a whistling sigh.

"Now why this Pett is flying yet
  Is a mystery to me.
For his Sole-Flight was a sorry sight—
  A horrid thing to see.

"'T was a splendid day when he got away.
  The sky was blue and clear.
I was glad 't was such, for I doubted much
  If he knew how to steer.

"Yes; he got away. And, strange to say,
  Despite his concrete dome
He left the ground and circled round,—
  So shrewdly round the drome!

"I saw him fly as smooth as I;
  And I saw him nose her o'er;
But my heart, it failed as his wires wailed
  And I heard his engine roar.

"He came down fast, and he touched at last;
  But I knew his hopes were vain.
He scarce was down on the earth so brown
  Ere he was off again;

"And his engine roared as up he soared
  Into the sky so blue.
I was amazed, in a manner dazed,
  Though I knew his brains were few.

"He came once more and nosed her o'er
  And pointed toward the ground.
Now all the crowd they groaned aloud,
  And I fell in a swound.

"Nine times he reeled around the field;
  Nine times he sought to land.
This could not be; and nine times he
  Went up to beat the band."

The aeronaut with his anguish fought,
  And his eyes were moist and red.
"Oh, one must soar if his engine roar
  And he won't switch off," he said.

"When I came to, to the dump I flew
  Where the recent crashes stood.
I found some wings, and some paint and things;
  And straight I made my way

"To the doping crew: while this Pett still flew
  His awful course around.
We brought the wings, and the paint and things,
  And we laid them on the ground.

"We made a sign with letters nine
  Or ten feet high, or more.
This had to be, that this Pett might see.
  'SWITCH OFF' were the words it bore.

"We saw him come, and we all were dumb
  As we watched him steer her home;
For we all knew that his brains were few:
  Would the words pervade his dome?

"Well, he understood, as we hoped he would,
  And his engine ceased to roar.
Thus ended right as wild a flight
  As e'er was seen, we swore.

"Now that's the why of my tearful eye
  And my air of melancholy.
I see them fly; then oft-times I
  Dream of this Pett, by golly."

I turned away, for I could not stay
  And see his awful grief.
The aeronaut was lost in thought,
  And I left him with relief.

—Ad Astra.

I syngge ye prayses of ye Fordde—
  Yt blessynge toe mannekynde
Yt calleth master onny manne
  Untoe ye lowlyest hynde;

Yt may be strooke by rayle rode trayne;
  Withstande ye fyre of gonne;
Yt may be pytch't from off a brydge:
  Yette wylle ye darn thynge ronne!

—Ad Astra.

A Breathing Spell

"My motto is, "Take everything you can get," said the boastful man at the club one evening.

"And do you always follow that motto?" asked the bored one, raising his head from his paper.

"Indeed I do," returned the other.

"Then suppose you take the air."

"What would you call the naked truth?"

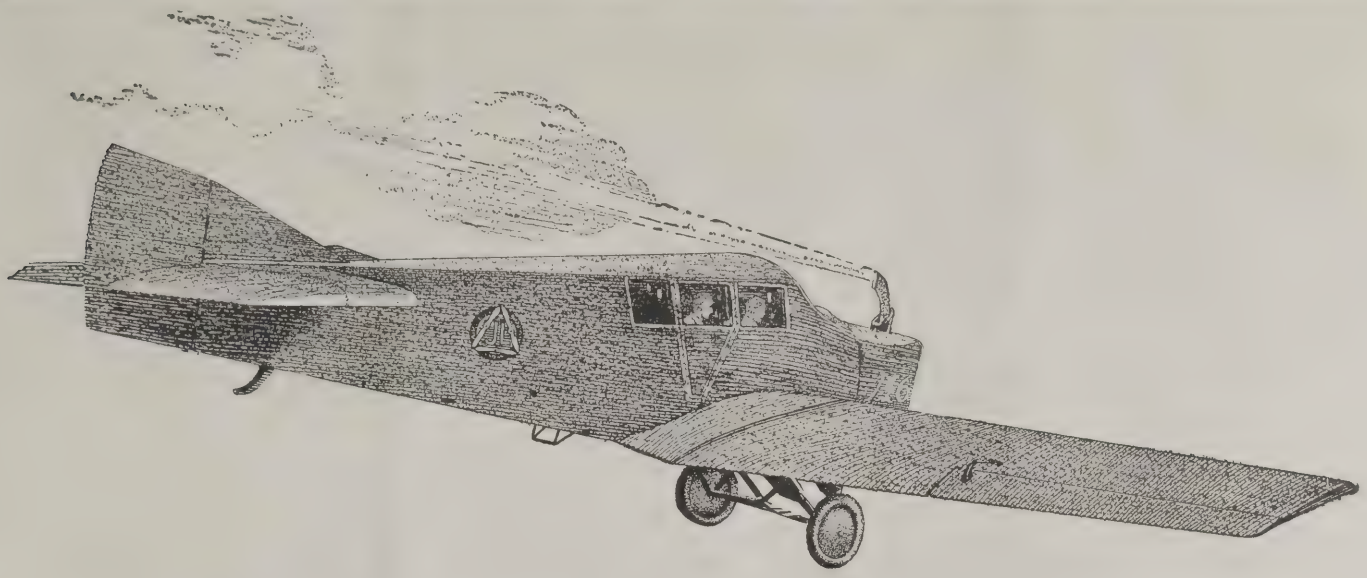
"Telling the bare facts?"

"No, failing to clothe your figures of speech."

Tick—"I am going to marry a doctor, so that I can be well for nothing."

Tock—"Why not marry a minister, so that you can be good for nothing?"

—Lehigh Burr.



Valspar is used for All-Metal 'Planes

Pilots
Eddie Stinson
Lloyd Bertaud

Mr. John M. Larsen



HE WORLD: SATURDAY

U. S. FLYERS BREAK DURATION RECORD IN ZERO WEATHER

EACH MAN FROSTBITTEN

FEEDING OIL TO ENGINE.

Fifteen hundred feet above the snow-whitened surface of Hempstead Plains, Eddie Stinson and

© Times Wide World

JOHN M. LARSEN

347 MADISON AVENUE
NEW YORK

January 9, 1922.

Messrs. Valentine & Co.
New York

Gentlemen:

This is to advise you that my plane, the JL-6 All-Metal Monoplane, that on December 30th, set a new world's record for endurance, on Long Island, by a sustained flight of 26 hours, 19 minutes and 35 seconds, was treated with your Valspar.

While our machines have no wood whatever in their construction, we still find that Valspar is the most durable and effective varnish that we could use. We have tried a number of other preparations, but have found that Valspar is the most effective.

Very truly yours,

John M. Larsen

VALENTINE'S
VALSPAR
The Varnish That Won't Turn White

VALENTINE & COMPANY
Largest Manufacturers of High-grade Varnishes in the World
ESTABLISHED 1832
New York Chicago Boston Toronto
London Paris Amsterdam
W. P. FULLER & CO., Pacific Coast

HERE IS YOUR OPPORTUNITY

Last fall a large business concern purchased from us two Curtiss JN4D's and one Canuck for a special purpose. This year larger planes will be required so they have authorized us to sell these planes at $1000.00 each. The planes are in excellent condition, fully equipped and ready to fly from our field in Dayton.

A few suggestions and prices of seasonable material will appear in these columns from time to time. **Follow these ads,** they will be interesting. We invite correspondence regarding anything in the aeronautical line.

L. V. G. with 220 Benz Motor	$2000.00	New Flottorp propellers, copper tipped	$35.00
Fiat Motors 300 H.P.	600.00	New Radiators, Curtiss or Standard	20.00
Hispano 150 H.P.	850.00	Leather Flying Coats	25.00
Hispano 180, slightly used	600.00	New casings, 26 x 4	9.00
Anzani 90 H.P.	250.00	New Goodyear tubes	2.50
Anzani 50 H.P.	250.00	Leather Helmets, chamois lined	4.00
		Goggles, Non-shatterable glass	6.75

JOHNSON AIRPLANE & SUPPLY COMPANY
Dayton, Ohio

The largest commercial aviation supply house in the country

TITANINE
TRADE MARK

DOPES AND COVERING MATERIALS

Can be obtained through

JOHNSON AIRPLANE & SUPPLY CO. Dayton, O.
FLOYD J. LOGAN 712 Superior W. Cleveland, O.
F. C. AYARS 329 East 81st St. Los Angeles, Calif.
JAMES LEVY 2055 Indiana Ave. Chicago, Ill.
DE LUXE AIR SERVICE Asbury Park, N. J.
ROBERTSON AIRCRAFT CORP., 5248 Oakland Ave., St. Louis, Mo.
or from
TITANINE, Inc., Union, Union County, N. J.

HARTSHORN STREAMLINE WIRES

Assembled with Hartshorn Universal Strap Ends make the Ideal Aeroplane Tie Rods—diminished wind resistance insuring greater speed.

This fact was proved in the speed test for the Pulitzer Trophy. Four of the first five ships were equipped with Hartshorn Streamline Tie Rods.

Write for circular A-1 describing our Wires and Strap End Fittings.



STEWART HARTSHORN CO.
250 FIFTH AVENUE, NEW YORK

NOW AVAILABLE FOR YOUR AUTO
"The Plug That Cleans Itself"

Saves Gas **B-G** More Power

GUARANTEED CARBON AND OIL PROOF

Recognized as the best for aeroplanes, its success for automobiles is assured

B - G CORPORATION
33 Gold St., New York

If your dealer cannot supply you, send us his name and $1.00 for each plug, stating name and year of manufacture of your car.

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet

PHILADELPHIA AERO-SERVICE CORPORATION

636 Real Estate Trust Bldg. **Philadelphia**

MOTOR REBUILDING

CYLINDER GRINDING
ALUMINITE PISTONS

Iron Pistons, Piston Pins and Rings.

COMPLETE MOTORS

Parts for all airplanes and motors.

Finest equipment in U. S. for motor work.

GREEN ENGINEERING COMPANY
Dayton, Ohio
Main St., at Burns

SPECIAL OFFER

New wheels with casing and tube

$12.00 comp. F. O. B. Buffalo

Canuck JN4 and 0X5

Spares and Supplies

Special prices from now until end of season. Act quick, don't wait until Spring to refit; use your spare time in the winter season.

Write us direct for quotations

ERICSON AIRCRAFT LIMITED
120 King Street E. **Toronto, Canada**

THE PETREL

DEMONSTRATED IN THE MIDDLE WEST

Three place biplane—four hours' fuel—high lift wings—speed range 31 to 80 m.p.h.—sturdy and light—accepted by U. S. Army.

— INVESTIGATE —

HUFF DALAND AERO CORPORATION

— Sole Distributors —

1018 COMMERCE BLDG. KANSAS CITY, MO.

WING COVERING

Accurately Done

Grade A Cotton 40c per yard.

Scalloped Cotton Tape 2¼" 4c per yard.

G. VOISIN, Expert

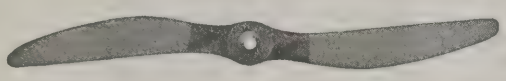
21 years of practical experience. Contractor to U. S. Air Mail

70-72 Rome St. NEWARK, N. J.

Tel. 9170 Market

STONE MANUFACTURING CO., Inc.

Supreme Propellers



For immediate delivery

Future Location, 2623 Olive St., ST. LOUIS, MO.

Pioneer Propeller Builders Established 1910

CANUCKS-OX5-AVROS-Le Rhone

Parts and Materials

Prompt Shipments

Lowest Current Prices

JAMES LEVY AIRCRAFT CO.

2035 Indiana Ave., Chicago, Ill.

CANUCK and OX5 SUPPLIES

Complete assortment at lowest prices

Recover your Canuck during winter months

1 Set (4) wing covers (cotton) with tape and dope....$69.00

2 Upper wing covers (cotton) with tape and dope.... 45.00

2 Lower wing covers (cotton or linen) with tape and dope 38.00

Single covers Upper $15.00 Lower $14.00

Acetate dope per gal. $1.00

Other material and parts at correspondingly low prices

AIRCRAFT MATERIALS & EQUIPMENT CORP.

1409 Sedgwick Avenue, N. Y. C.

IN order to make room to start manufacturing our three place $2500.00 American product of high efficiency and economy airplane we offer new linen and cotton covered Canuck wing panels at $100.00 each. New rudders, new elevators, new ailerons, each $16.00. OX5 motor parts 50% off. New propellers —each $17.50, OX5.

PARKER AIRCRAFT CO., Perry, Iowa

Advertising in this department 10c a word $2.50 minimum

Classified Advertising

Forms close for this department on Monday preceding date of issue

PATENTS Ex-Pilot U. S. Air Service

ALLEN E. PECK

Patent Attorney

Pacific Bldg., Washington, D. C.

WANTED—2 new OXX-6 motors. Offer new Canuck with nearly new OX-5; or rebuilt Canuck and cash; or cash if price is low. DeLuxe Air Service, Inc., Asbury Park, N. J.

FOR SALE—Gnome 150 H.P. Motor used about 6 hours. Very fine shape. Sell cheap or trade on damaged ship that can be repaired. A. C. Reed, 3822 Park Ave., Kansas City, Mo. Phone Wabash 3616.

COMPLETE SET NEW J1 Standard wings, wires, struts, tail, unit never uncrated. Selling less than $200. Any single panel $50. Planes also. Write Box 651 c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

STANDARD J1, new, complete, less motor and instruments, $625.00. Can furnish Curtiss OX5 perfect, $150.00. Write for complete installing cost. Wings, propellers, fittings all aeroplanes. Box 652, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

MUST SACRIFICE the folowing material to make possible the production on new planes. Elevators, rudders, ailerons newly covered, $10.00. All fittings 5-40 cents. Floor boards complete, $1.50. Any strut $1.00. Other parts as cheap. Send for list. Address Box 144, Williford, Ark.

WANTED GNOME PARTS—Cylinder pistons, rings, plugs, starter and propeller for monosoupape 100 H. W. Lenert, 4138 N. Drake Ave., Chicago, Ill.

FOR SALE — New OXX6 engines — New Hispano Suiza 180 H.P. engines. Baltimore Sales Agency, 439 Equitable Bldg., Baltimore, Md.

SPECIAL FOR LAIRD SWALLOWS—New round Rome Turney radiator and D-5000 new Mahogany propeller—both for $40. Canucks, $800 to $1,500. Canuck blueprint, $1.50. OX5, OXX, JN4C and JN4D parts—lowest quotations. DeLuxe Air Service, Inc., Asbury Park, N. J.

FOR SALE—Practically new Curtiss JN4 ready to fly $700.00. Write A. B. Agnew, Templeton, Pa.

FOR SALE—Canuck plane, new 1921, privately owned. No exhibition or passenger work. Absolute A1 condition. Owner buying larger plane. C. H. Cloos, 33 E. North St., Buffalo, N. Y.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

AVIATION EXPERTS trained with us are successful. Practical work. Flying if wanted. Employment service. No experience necessary; only ambition. Write Leslie Coombs, Chief Engineer, Central Airplane Works, 843 Windsor Ave., Chicago.

AVIATION COURSE in full swing. Earn your tuition while here. Your chance to become an aeroplane mechanic. Hogan Aviation School, 2623 McGee Trafficway, Kansas City, Mo.

FOR SALE CHEAP—Practically new 1920 Aeromarine flying boat, OXX6 motor and spares. Can be bought either with or without motor. Boat used twenty hours. Condition perfect. Peter Ingebrethsen, South West Airplane Co., Tulsa, Okla.

NEW LIBERTY MOTOR, Army Type, 12 cyl. 400 H.P. Cost $4600. Will sell for $2150; also one used Navy Type Liberty motor—perfect condition—$750 F. O. B. Portland. Address L. L. Adcox, 374 Wasco St., Portland, Ore.

CURTISS JN4D2, Wings just recovered, motor overhauled, perfect, complete, $900. For deposit will hold till spring. Write Marvin Northrop, Minneapolis Athletic Club, Minneapolis, Minn.

NEW AVRO new 110 LeRhone motor, instruments complete, best condition possible. Easily rebuilt for three passengers. Price $1200. Write Box 648, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

EX-SERGEANT, 5 YEARS EXPERIENCE repairing planes and motors. Specialized on Curtiss. Desires steady position with reliable party. H. Gerbins, 4630 Prairie Ave., Chicago, Ill.

NEW AVROS $650 to $1500

Stationary or Rotary Motors

C. D. Chamberlin

Hasbrouck Heights, N. J.

WANT TO SELL CANUCK, in excellent condition, ready to fly away, cheap. Or will trade for good automobile. Wm. C. Steckel, 113 W. Herman Ave., Dayton, Ohio.

WANTED—Model F or MF. State price, age, condition, motor, location, etc. Address Box 649, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

WANTED TO TRADE, for plane, motorcycle, bicycle, welding, vulcanizing and battery business, for Canuck or Jennie, or what have you? Address Box 650, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

FOR SALE—New OXX Curtiss motors, original crates, immediate shipment, price $575, limited supply. Wire Baltimore Sales Agency, 439 Equitable Bldg., Baltimore, Md.

MODEL AEROPLANES AND SUPPLIES— Let us supply you. Send for our latest catalog. 10c brings it to you. Wading River Mfg. Co., 672-AB, Broadway, Brooklyn, N. Y.

YOUR LAST CHANCE to learn to fly for $195. We lack three students of having our introductory class filled. Our price thereafter will be $250. Indian Lake Aviation Co., Russell's Point, Ohio.

RUBBER CORD for aeroplane shock absorber made to meet Government specifications. Following sizes are in stock for immediate delivery: ⅜", ½", 7/16". The Russell Mfg. Company, 349 Broadway, New York City.

AVIATION NEEDS YOU—Learn to fly at the Varney Aircraft's land and water flying school. Write for descriptive literature. Varney Aircraft Co., 2606 Main St., Peoria, Ill.



LEARN TO FLY

in Chicago with

THE RALPH C. DIGGINS CO.

YOU start flying the day you arrive. Competent Instructors. Newest Types of Planes. Gosport System of Instruction. Thorough Ground Course, including instruction in motors, plane-assembly, wireless, navigation, cross-country flying, field management. Living quarters right here on the field.

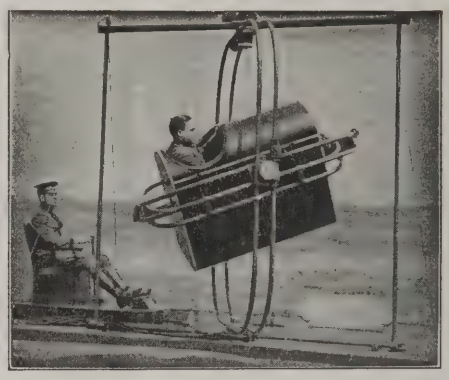
Special correspondence course prepares you for Spring flying classes.

PILOTS Receive $5,000 Per Year and Up
ENROLL NOW!
Write for literature and enrollment offer.

THE RALPH C. DIGGINS CO.
Dept. 203, 140 N. Dearborn Street, CHICAGO, ILL.

These Models of the

Ruggles Orientator



were manufactured by the U. S. Government under the supervision of the inventor. Duplicates—with improvements—will now be manufactured for civilian aviation schools, also 2 passenger models for amusement park purposes.

Foreign and Domestic Patents Allowed and Pending

Ruggles Orientator Corporation

168 W. 73d Street, New York City

AVROS

"Acknowledged the best all round plane for passenger carrying"

2 and 3 Passenger
New and Used

We are headquarters for Avro and Le Rhone spare parts

THE LAWRENCE SPERRY AIRCRAFT CO., Inc.

Farmingdale, New York

Phone Farmingdale 133

WHAT IS YOUR CHANCE?

to get into Aviation? Mr. L. B. Coombs, Chief Engineer of the Central Airplane Works, has written a booklet on Aviation and how to get into the game. Drop him a card asking for it. He will gladly mail it to you free.

Address, 843 WINDSOR AVE., CHICAGO, ILL.

LEARN AERONAUTICS

GOVERNMENT EXPERTS AS INSTRUCTORS

Home-study and residence courses in Airplane Construction and Navigation, Aerodynamics, and Airplane Engines.

Dean, Richard A. Smith, B.S., B.E., Testing Engineer, Aerodynamic Laboratory, U. S. Navy Yard. Write for catalog to the

School of Aeronautics, RESEARCH UNIVERSITY,
20 Jackson Place, Washington, D. C.

JN4D fuselages, good shape, less fabric	$125.00
" " skeleton	40.00
JN wings, good shape, less fabric	15.00
J. M. Tachometers in need of overhaul	10.00
Zenith Carburetors OX5	15.00
JN fuselage fittings	.25
B. G. Spark Plugs, good shape	.20
Slitdorf Spark Plugs, good shape	.10
OX5 Motors in need of light overhaul	200.00
26 x 5 Casings, new	3.00

Complete stock of Curtiss parts, as well as D.H., Spad, SE5, Fokker, Low prices. Fokkers, Wings good, Fuselage to be recovered $100.00. Thomas Morse single seaters, poor order. Fuselage $15.00.

FLYING U SCHOOL OF AVIATION
So. San Antonio Box 25 Texas

CURTISS SHIPS FOR SALE

$500.00 AND UP

CURTISS EASTERN AIRPLANE CORP.
130 S. 15th STREET PHILADELPHIA, PA.

(*Continued from page 618*)

of the most money-saving aeroplane in the world does not place the owner in a very much better position.

Is it too much to ask that all aeroplanes used on say the London-Paris service should be able to land and pull up with absolute safety almost anywhere in the country en route? If this cannot be done then are we not bound to conclude that aerial transport is inherently much more dangerous than transport by land and sea?

How much is it that would have to be sacrificed in order to render machines capable of taking off quickly and landing safely and providing them with stronger under-carriages, with much greater shock-absorbing capacity and capable of being brought to rest within 60 yards after touching the ground? There would of course have to be some sacrifice both in respect to top speed and percentage of useful load but would it not be compensated for many times over if the public came in hundreds instead of tens?

It would have an immensely reassuring effect on the public mind if they knew that before a commercial aeroplane could receive a certificate of airworthiness it had to make say ten forced landings on a given route immediately upon receiving wireless instructions from the ground and at moments selected entirely by the wireless operator. I venture to think that there are few who would care to accompany the machines on such a test but the majority of pilots in the course of a year will probably have to make some forced landings and not always under the happiest conditions in regard to weather.

Aerodromes.

Sufficient attention has not yet been given in any country to the perfecting of the aerodromes in use. Even at Croydon and Le Bourget there are obvious improvements called for but for some reason or another time drags on without the defects being remedied. There are few aerodromes in which it is possible to take-off with equal safety in any direction; it certainly is not the case at the two aerodromes just mentioned and it appears almost easier nowadays to tear down a dynasty than half a dozen poplar trees.

We know that the aerodromes are provided by the various Governments helping civil aviation, and it is not desired to appear ungracious, but one is strongly tempted to wish that the various Governments had to obtain licenses for their aerodromes from some independent body before they could be used. Further there is not a single public aerodrome properly equipped with apparatus by which loaded aeroplanes can be readily weighed or the position of their centre of gravity determined, and it is nothing short of remarkable that more accidents do not occur as the result of ignorance as to these two vital factors.

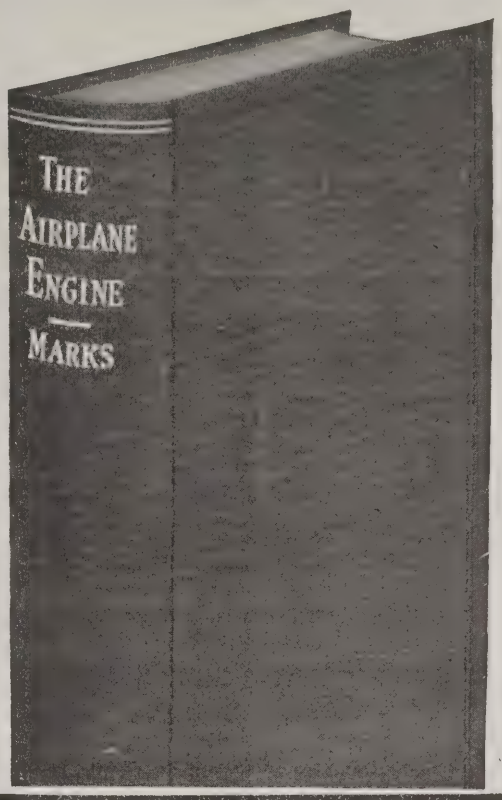
Meteorology and Wireless Services.

Experience shows these two services to be the twin guardians of safety in the highest possible degree. Times innumerable machines have been saved from danger by timely warning by wireless telephone of sudden changes in the weather conditions, apart from which in a very large number of cases it would not be possible to undertake the journeys at all if it were not for the meteorological information transmitted by wireless beforehand. During the past year the departments responsible for this work have made rapid strides towards perfecting their organisation and in enlarging its ambit and I think I shall be voicing the views of many in the audience in returning thanks for all the help and friendly co-operation received from these two very important departments.

The services also of the Marconi Company and the constant work of their able staff on the development of wireless telephony has been of the very greatest value and the improvements that have been made are of a most substantial and gratifying nature.

Any suggestions that have been made for the improvement of these two departments are generally concerned with a possible sub-division of the work in the wireless department. At present there is no wireless operator acting solely as watcher and guide to the machines in the air. At one moment an operator may be talking to a machine and then for fifteen minutes or more he may be engaged on transmitting or receiving weather reports or writing out messages. It is considered that the work should be divided and one or two operators should do nothing but talk to machines in the air keeping them posted all the time on weather conditions and other necessary information, giving them a bearing even in fine weather and in effect helping the machines with all the meteorological and other information that becomes available as their journeys proceed. In view of the expected increase in traffic next year this question assumes a very real importance.

(*To be concluded*)



HERE ARE 5 REASONS why designers and builders of airplane engines, pilots, mechanics and students should examine

The Airplane Engine

(By LIONEL S. MARKS)

(Professor of Mechanical Engineering, Harvard University)
(454 pages, 6 x 9, 349 illustrations, $6.00 net, postpaid)

1. It is the first complete summary of existing information on the airplane engine and its auxiliaries.
2. It discusses in detail the construction of those engines that have proved themselves efficient.
3. It brings you in one volume the result of all the experience and investigations of the United States, British, French, and German governments.
4. The author is Professor Lionel S. Marks, Editor-in-Chief of Marks' **Mechanical Engineers' Handbook**, who has had exceptional facilities for reviewing the research in this field.
5. The book covers the subject so fully, everyone interested in the refinements of internal combustion engines will find it of great value.

Its thoroughness, authoritativeness, and wealth of detail, will make this book the standard treatise in this field for many years to come.

As an example of the book's thoroughness, take Chapter X

This chapter takes up the carburetor. It discusses such topics as theoretical flow of air through a restricted tube, the choke of a carburetor, pulsating flow, he flow of fuel through a nozzle or jet, mixture characteristics of a carburetor with constant air density and with variable air densiy, performance of representative carburetors, altimetric compensation, viscous flow carburetor, altimetric control, atomization, pressure drop, idling, acceleration, carburetor construction.

**Examine this book for 10 days FREE.
Mail the coupon below — today.**

Free Examination Coupon

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York, N. Y.
You may send me on ten days' approval: **Marks' Airplane Engine, $6.00 net, postpaid.** I agree to pay for the book or return it postpaid within 10 days of receipt.

Subscriber to Aerial Age?.....

(Signed) .....

(Please Print)

(Address) .....

Official Position .....

Name of Company .....

(Books sent on approval to retail purchasers in the U. S. and Canada only.)
A.A.3-6-22.

Evidence

THE fact that Aerial Age Weekly has by far the largest circulation of any aeronautic periodical in the United States is evidence of the fact that it carries the news while it is news and deals authoritatively with the many phases of world aeronautic progress.

It digests every aeronautic magazine in the world for the benefit of its American readers, and takes the story of American progress to the far corners of the globe.

Aeronautic events of great importance are pending and everyone who would be completely informed on the successive steps in the progress of these events should instruct us to place their names on our subscription list for the next year.

Simply sign the form below and we will do the rest.

AERIAL AGE WEEKLY,
280 Madison Ave., New York.

Please enter my name on your subscription list for one year and bill me four dollars (foreign six dollars) when service has been started.

(Signed) .....

Address .....

.....

CONTEST COMMITTEE
OF THE
AERO CLUB OF AMERICA

Request all owners (individuals or companies) of aircraft in the United States to register in order that the Committee may

1. Send, gratis, the Aero Club's Contest Rules for 1922, and notices of proposed aviation meets.
2. Assist local Clubs in organizing contests best adapted to the types of airplanes in their locality.
3. Have a record of airplanes and pilots available throughout the country in times of emergency.

—Use This Form—

Date.....

Contest Committee, Aero Club of America,
11 East 38th Street, New York City.

I / We { have..... / Give number) } { Airplanes / Seaplanes / Flying Boats / Dirigibles / Free Balloons } Make and Model.....

Motor, Make and Model.....

Maximum speed of.....m.p.h.

Capable of continuous flights of.....miles.

Cubic capacity of gas bag.....cu. ft.

Underwriters Laboratories Aircraft Registration

No.....

Pilot's name .....

Address .....

Owner's name .....

Address .....

AA

SPECIAL OPPORTUNITY

To Secure a Copy of the

Textbook of Aero Engines

By E. H. SHERBONDY and G. DOUGLAS WARDROP

Together With One Year's Subscription to

AERIAL AGE WEEKLY

The Leading Technical and Trade Aeronautic Publication in America

The Textbook of Aero Engines has been prepared for the purpose of having in one volume the complete information concerning all modern types of aero engines and an up-to-the minute discussion of the principles of aero engine design and construction, so that the reader may be able to undertake comparative research without recourse to a formidable list of volumes and publications, which in any event could only supply him with more or less obsolete information.

AERIAL AGE WEEKLY discusses and describes all current developments in the aero engine field, so that with the Textbook and consecutive copies of AERIAL AGE the subscriber will possess a complete encyclopedia on the subject.

To AERIAL AGE WEEKLY
280 Madison Ave., New York

Please send me a copy of the Textbook of Aero Engines (regular price $10.00), and enter my name on your subscription list for one year (regular price $4.00). I desire to take advantage of securing both at the special price of $10.00, and am enclosing my check for that amount herewith.

Name .....

Address .....

QUALITY SNAP RINGS

More Than a Million a Month



The world-famed Oldsmobile is *also* equipped with Quality Snap Rings.

THE Piston RING COMPANY

MUSKEGON, MICH.

Carey-Craft
THE CAREY PRINTING CO. INC
NEW YORK

UNIVERSITY OF ILLINOIS-URBANA
3 0112 047077372